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THE ART OF MANURING IN NEW ZEALAND.

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ONE and a quarter million New-Zealanders last year spent over £1 per head on phosphates brought from overseas for manuring the soil. This fact is enough to warrant the devotion of a little thought to a big practice which shows signs of still more vigorous growth.

Phosphate, it is only right, should bulk greatest in the farmer's manure bill. Three kinds of bodies are recognized by the laws of all countries governing the sale of manures, or the stuff from which so-called artificial fertilizers are made. These are substances containing nitrogen, potash salts, and phosphates. In the markets of the world the price of these is in the order in which they are set down, nitrogen costing about five times and potash twice as much as an equal weight of phosphate. It seems providential that what is most needed for New Zealand soils should be the cheapest of the three. It is further satisfactory to know that although available nitrogenous manures are quickly leached out of the soil and disappear into the rivers and sea, phosphates are only lost to a very limited amount. New Zealand soils are for the most part well supplied with nitrogen in an insoluble or unavailable state, from which nitrogen becomes liberated in an available state from time to time sufficiently for ordinary crops. There does not seem to be any reason to worry about nitrogen or potash supplies, but the increasing demand for phosphate suggests that every precaution should be taken to ensure that the full value is obtained from the use of it.

In spite of the fact that nitrogen and potash are so dear and phosphates so cheap, the elements from which nitrogen and potash manures are made are much more abundant in nature than phosphates, four-fifths of the atmosphere consisting of nitrogen, and the soil containing much nitrogenous organic matter. The crust of the earth is estimated to contain about 2·5 per cent. of potassium, but

only 0·1 per cent. of phosphorus. The more abundant elements are dearer because they are in a state which plants cannot use as food. By natural processes more or less slowly, and by artificial methods more or less costly, these inert manurial elements may be made available.

It is fortunate for New Zealand and Australia that the farming demand in the Northern Hemisphere is predominantly for nitrogen rather than for phosphate, while the reverse is the case in the Southern Hemisphere, and that happily within a few days' steam there should be such high-grade deposits of phosphates as those existing at Nauru and Ocean Islands. The leading idea in our southern systems of manuring should be to import only the element which is absolutely deficient in the soil, as phosphate, and to rely on internal sources when the necessity arises for using those elements (nitrogen and potassium) which are present but not immediately available.

The quantities and approximate retail values of fertilizers imported into New Zealand for the year ended 31st March last were as follows, values being given in round numbers:—

	Tons.	£
Phosphates—		
Bonedust	2,452	24,500
Bone-char	396	2,500
Basic slag	45,682	247,000
Rock phosphate..	108,163	702,000*
Egyptian phosphate	8,530	50,000
		£1,026,000
Potash—		
Potash salts	7,416	£65,000
Nitrogenous Manures—		£
Sulphate of ammonia	841	15,000
Nitrate of soda	816	15,000
		£30,000

* After grinding, bagging, &c.

Rock phosphate is the only one of these fertilizers which is imported in the unmanufactured state, and the figure £702,000 is arrived at by assuming that all the rock phosphate is bought by the farmer as ground rock phosphate. A large quantity, however, is made into superphosphate, which much increases the cost; and it is estimated that the portion of the imported phosphate made into super costs the farmer £350,000 more than if it had been merely used as ground rock. This amount, together with a small amount for phosphate rock locally produced and the retail value of the phosphate produced by meat-works in New Zealand (estimated to be about £50,000), makes the total amount spent for phosphates as follows:—

	£
Imported phosphates	1,026,000
Cost of making portion into super	350,000
Locally produced phosphates	50,000
	£1,426,000

To the importations of potash and nitrogenous fertilizers set out in the first table may be added the organic manures produced at local meat-works, the retail value of which is estimated at approximately £200,000. The combined value of these classes then totals the substantial sum of £295,000. The preponderance of the expenditure on phosphatic fertilizers, nevertheless, is overwhelming.

SELECTION OF APPROPRIATE FERTILIZERS.

The selection of an appropriate fertilizer for any crop is governed by a consideration of the facts relating to (1) the soil, (2) the crop, and (3) the climate.

It is important in this country that one should disregard any practice which is followed in the Old World in manuring any particular crop. The conditions of climate and soil here are entirely different from those obtaining in England, or indeed, the Northern Hemisphere, and should one endeavour to be guided by what is usual in *our* antipodes the New Zealand farmer will be sadly led astray The most striking instance of this is in the manuring of cereals. In England oat and wheat crops are manured with a fertilizer which is essentially nitrogenous, but in New Zealand it is to phosphates the farmer looks to increase his grain crop, and this is true also in Australia. It is probable that in New Zealand the rate at which nitrogenous matter becomes available is much greater than in the colder northern soils.

The soil, from the farmer's point of view, is either heavy or light, the heaviness being due to the presence of unusual amounts of clay and sometimes silt; or it may be obviously sandy or gravelly, or peaty land derived from the drainage of a swamp. In some cases dune sandy land may be converted into quite a different soil by the admixture of peaty matter. The sandy land loses all its characters peculiar to sand, and will then respond well to lime and other treatment appropriate to heavier soils.

With heavier soils, in a district with a well-distributed and good rainfall, alkaline manures such as basic super, slag, and other phosphates applied in conjunction with quicklime (but not necessarily in the same season) are indicated; with the lighter soils acid dressings and carbonate of lime. The extreme type of sandy soils should not, as a rule, be limed, but improvement in the texture should be effected by turning in green manure or applying other manures rich in organic matter. It is best not to apply alkaline manures to sandy soils, but acid and alkaline phosphates (*e.g.*, basic slag and super) may be mixed to produce a neutral manure, with every prospect of being extremely beneficial on sands. A sandy soil is a droughty soil, and successful farming on sandy soils is contingent not only on a heavy but on a well-distributed rainfall. Fortunately, some of the greatest areas of sandy lands are so interspersed with swamp lands and loams, where the conditions are exactly reversed, that defects of one type are balanced by those of the others on the same farm. The scientific farmer must apply one treatment to his sandhills and another to his swamps, and it must be remembered that extreme types of soil, whether they be excessively tenacious like clay soils or excessively friable like sands or

fine gravels, must have an extreme treatment. If artificial manures are applied to such soils without previous treatment to improve their physical state the fertilizers will be largely wasted.

With heavy clays which puddle when worked wet the application of quicklime is at the outset forced on the farmer; but sandy soils may give results for a number of years before their lack of response to fertilizers forces the farmer to realize the necessity for green-manuring. Some kinds of sandy lands containing a large amount of silt tend to pack after working and allow the surface water to lie. It is to these soils that green-manuring has now grown so necessary that further improvement must be on the lines of an organic manuring before artificials can obtain a full response from the crops.

Peaty or drained swampy soils which contain a large amount of organic matter should be treated with insoluble fertilizers *after draining*. Such soils are strong solvents of many minerals insoluble in pure water, and applications of such material as sand, clay, pumice, papa, or even gravel may be used to supply the deficiency in mineral plant-food and render the soil easier to drain and work. Basic slag or ground raw phosphate of any insoluble kind will work wonders on such lands. The lime-requirement of such lands is very high—much higher than any farmer could hope to satisfy—and therefore it is a somewhat superfluous task to determine what the lime-requirement is. The proper quantity of lime to put on such a soil is as much as the farmer can afford. This will be well within the requirement.

With these preliminary remarks on the importance of obtaining what is known as good tilth, the study of the use of artificial fertilizers may be commenced.

CLIMATIC INFLUENCES (NORTH ISLAND*).

With regard to the climate as a factor in modifying the manuring of the soil, most of the North Island has a rainfall of under 70 in., according to the rainfall map issued by the Meteorological Office. The exceptions to this are not many. Areas round Napier, Cape Palliser, and Wanganui have a rainfall of under 40 in. Gisborne has slightly more, but under 50 in. There are some very high rainfalls in a few higher levels containing areas of no agricultural importance, so that generally speaking one may say that the country is exceptionally well watered and has an average rainfall of under 70 in. Hawke's Bay has the only climate which would modify the manuring, and in this would indicate the use of superphosphate, and contra-indicate the use of basic slag where a phosphate is to be used. Or, speaking more generally, more soluble manures should be used in a climate like that of Napier, in which 33 in. of rain falls on 102 days, than in one like Auckland, where 43 in. falls on 183 days.

THE GREAT NEED OF PHOSPHATES.

In 1913, after some fourteen years spent in analysing soils from all parts of the Dominion for their manurial ingredients, for both "total"

* South Island references under climatic and other headings will be made in a later article of this series.

and "available" plant-food, the writer ("Phosphates," this *Journal*, vol. vii, p. 121) showed that, broadly speaking, soils of the northern part of New Zealand, especially those of Auckland, were much poorer in phosphate than those of the South Island. Phosphate deficiency of soil is the outstanding defect throughout New Zealand, and it is the means of supplying this deficiency that must be first considered.

All kinds of phos [illegible] luble in water, obtain a wonderful response fr[illegible] New Zealand soils. The water-soluble superph[illegible]e phosphate in basic super and slag, and the wa[illegible] raw phosphates all give excellent results and [illegible] oil-analyses, which show that phosphate is uni[illegible] in lands. Unfortunately, this general recognition of the necessity for phosphate has led to great quantities being applied year after year as a sole means of obtaining growth response. Amounts have been put on which cannot possibly have been recovered in the produce — crops and stock which are obtained from the soil.

Since this constant application of phosphate has become a stereotyped practice, it is well to consider what becomes of the phosphate, a comparatively small portion of which is removed. The Rothamsted experiments have shown that phosphate is not lost by leaching to any extent on that soil. There is therefore only one explanation why more phosphate should be required every year, and that is that it is becoming unavailable in the soil. This is especially liable to occur when a water-soluble phosphate is applied to a soil in which there is no calcium carbonate. The phosphate is precipitated in the soil, and if there is no calcium carbonate with which to combine the phosphate the latter no doubt combines with the bases, iron and aluminium. When in this form it is usually regarded as being unavailable for plant-food.

Some attempt should be made to determine whether lands which have been top-dressed for years with phosphate will yield some of their wasted phosphate fertility when treated with lime in one of its forms. But a more rational way of going to work would be to apply lime to the soil before dressing with super, thereby assuring a base in the soil to fix the super, and which at the same time does not permit the phosphate to be thrown out of action by being converted into highly unavailable compounds. We know that the calcium phosphates are all available when finely distributed in the soil, and it should be the aim of every farmer to keep the phosphates available by liming or mixing them with lime, rather than to continue to supply an acid manure year after year.

FUNCTION OF PHOSPHATE.

Phosphates of calcium hasten the growth of plants, having a very strong action on the young plant and greatly stimulating the development of roots; phosphates increase the proportion of grain to straw and lessen the time the plant takes to reach maturity. Owing to their great influence on root-development phosphates are especially valuable in use with shallow-rooting crops such as barley and turnips. Phosphate has many other functions, but one of the most noticeable effects is the extraordinary increase in palatableness of pastures top-dressed with phosphates. Stock will travel for miles to graze off top-dressed pasture,

and if a small area on a farm is dressed with phosphate and not fenced off the stock will remain on that area and graze it as closely as a lawn.

The clovers belong to a family of plants which are greatly stimulated by phosphates. Members of this family, the legumes or pod-bearing plants (Leguminosæ), can obtain the nitrogen they need from the atmosphere with the aid of certain micro-organisms which grow in attachment to the roots of legumes to their mutual good (symbiosis). Hence a dressing of calcium phosphate, by increasing the amount of clovers in a pasture, also increases the nitrogenous organic matter and so improves the soil. The organic matter by its decay creates humus, and humus makes available other plant-food, including potash. Hence application of phosphates establishes a cycle of improvement which is as far-reaching as it is important. The most nutritious pastures in England and the best dairy pastures in France are those richest in phosphates.

One cannot consider the action of phosphates on soils without at the same time taking into consideration other fertilizers, and what are called in America "amendments" to the land. An amendment is some bulky and cheap material which is used for improving the soil, but, containing no appreciable amount of nitrogen, potash, or phosphoric acid, it cannot rightly be called an artificial fertilizer. Such amendments are lime in any of its forms, stable manure, or any crude refuse used for improving the tilth but not directly for supplying plant-food. Of these carbonate of lime is in New Zealand the most important. This is merely limestone which has been dried and ground to a condition which enables it to be sown by a drill or lime-distributor. There are very few North Island types of soils which contain carbonate of lime in the virgin state. Some of the rivers which flow through papa country deposit a sediment from floods which top-dresses the land with material containing a few per cent. of carbonate of lime. The best example of this is at Gisborne ("Notes on Some Poverty Bay Soils," this *Journal*, vol. xvii, p. 196). Another instance is the material erupted at the time of the Tarawera eruption in 1886. This particular material fell as a mud, and it now contains several per cent. of a calcareous compound soluble in dilute hydrochloric acid but which is not calcium carbonate. In papa soils the calcium often exists as a carbonate to the extent of a few per cent.

Probably the most important function of carbonate of lime on New Zealand soils lies in the favourable influence which a good supply exerts both on the phosphates naturally present in the soil and on those which are artificially added. Lime prevents the formation of those phosphates of iron and aluminium which are with difficulty available as plant-food. Hilgard, the American agricultural chemist, held that where carbonate of lime was in excess, phosphates might be present in very small amounts, and yet more satisfactory returns be obtained from the land than when lime was deficient and much phosphate was added. This has been found to be the case in New Zealand. Some of the most fertile lands are those which have carbonate of lime naturally in the soil. The lesson to be learnt from this is the need of trying to economize in the application of phosphates by liming those soils which do not effervesce when a small portion is thrown into a dilute solution of spirits of salts (hydrochloric acid).

NITROGEN.

The next important plant-food to consider is nitrogen. This manurial ingredient is always found in commerce as ammonium salts, nitrate of soda, dried blood, bonedust, or sundry organic manures made by meat-works. It is most largely used in the insoluble form in proprietary mixtures. Those saline forms, *the nitrates and the ammonium* salts, are used to a small extent, but mainly by market-gardeners. Nitrogen has a very great influence on the leafy parts of plants, and in those crops which are grown for their leaves nitrogen is a valuable fertilizer. The amount used in this country compared with phosphates is insignificant. One may notice that nitrogen delays the maturing of the plant by encouraging the vegetative phase to retard the reproductive phase. Its action is thus opposed to that of phosphate, which hastens the fruiting stage of the plant, thereby securing early maturity and early harvests—a point of considerable importance in temperate countries with uncertain seasons.

POTASH.

Potash manures are known to exert a very favourable influence on the health of the plant, making it more resistant against the attacks of fungoid diseases. Potash is essential to the formation of carbohydrates, such as starch, sugar, and cellulose. When the supply of potash is deficient the manufacture of carbohydrates is greatly reduced. Crops rich in these compounds, such as mangolds and potatoes, are said to be specially benefited by potassic manures. Potash tends to prolong growth in cereals and to hasten maturity in mangolds. Comparatively only a small amount of potash manures is imported into New Zealand.

One would like to see authoritative experiments undertaken locally to determine the value of this class of artificials. The action of potash in stimulating the growth of clovers is stated by European authorities to be very marked. The growth of clovers is most marked in all New Zealand soils even without potash applications. Soil-analysis does not indicate any deficiency of potash in New Zealand virgin soil, and the active growth of clovers without help from any added potash would seem to bear this out. For special crops such as potatoes, mangolds, and rape it is, however, always advisable to add potash on all soils, and on black peaty soils it will probably be found beneficial for all crops. It is said that potash shows good effects on sandy or gravelly soils, but it must be remembered that New Zealand sandy soils, whether dune-sands or pumice-sands, are well supplied with potash minerals. Both magnesium and sodium salts attack the insoluble potash minerals in the soil, and liberate potash from them in a state suitable for absorption by plant-roots. Coastal lands may therefore have potash supplied naturally through the action of the sodium chloride brought ashore in the sea-spray.

THE MIXING OF FERTILIZERS.

In the mixing of fertilizers it is important for the farmer to remember one or two cardinal points. Alkaline and acid manures may be mixed only under certain conditions. Thus basic slag and superphosphate if mixed and allowed to stand will set to a hard mass, which

will, if allowed to remain long enough, have to be broken down by a sledge-hammer before it can be distributed. Hence such a mixture must only be made in small quantities at a time and distributed at once. After each day's work the drill or distributor should be thoroughly cleaned out. The alternative to this procedure is to mix in some diluent which will keep the mixture from setting. An equal bulk of dry pumice or other sand will be very useful in this work, or bonedust or ground rock phosphate may be used if available.

Another point is that alkaline manures must not be mixed with nitrogenous organic manures or ammonium salts. The quicklime or any substance which contains it, such as basic slag, must on no account be mixed with meat manure, blood and bone, or ammonium sulphate. If such a mixture is made, the valuable and volatile ammonia gas is formed, driven off into the atmosphere, and so lost to the farmer. Of course, if basic slag is first mixed with superphosphate until an acid or neutral mixture is formed, and then mixed with blood and bone, no loss will result.

Carbonate of lime may be mixed with superphosphate and mixtures containing superphosphate. Such a mixture drilled in with the seed gives an excellent result with cruciferous crops such as turnips, swedes, and rape, which greatly benefit by an alkaline manure, even on pumice or sandy soils. This is the one exception to the use of lime on pumice lands. The slag-super mixture is, however, likely to give even better results with turnips.

Kainit is a favourite potassic dressing, but it must not be mixed directly with superphosphate and allowed to stand, otherwise it will become a sticky, unmanageable mass. By using a diluent and sowing it quickly in small quantities such a mixture may be safely made. It is perfectly safe to mix superphosphate with sulphate of ammonia, but if mixed with nitrate of soda such a compound must be sown at once.

Generally speaking, any mixture may be made if enough diluent is added and the mixture is not allowed to become alkaline in the presence of ammonium salts or nitrogenous organic matter.

(To be continued.)

Cream-grading.—In his last annual report the Director of the Dairy Division makes the following remarks on this subject : " The general consensus of opinion amongst the large majority of suppliers and those in control of dairy factories is that the grading should be made compulsory. Voluntary grading would be nearer the ideal, could it be effectively carried out generally. I am of opinion that it will not be so carried out, and that the earlier a compulsory system is approved by the Department the better will it be for all interested in the dairy industry and who have the real interests of the industry at heart. Legislation is, I believe, necessary for providing for a differential payment for second-grade cream, and without this compulsory grading would be useless. Compulsory grading with differential payment would add greatly to the effectiveness of the farm-dairy instruction work."

Bee-diseases.—During 1924–25 further material was collected by the Biological Laboratory in the study of *Nosema apis*, but the organism thus far could not be associated with any specific disease. Another disease of bees—paralysis—was dealt with from a bacteriological standpoint, but from many examinations the presence of bacteria which would account for the disease could not be demonstrated.

THE BRONZE - BEETLE.

ITS HABITS AND CONTROL AS AN ORCHARD PEST.

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MOST of the insects injurious to orchard trees and fruit in New Zealand can be successfully held in subjection by the usual spraying practices. One of the few species that so far has evaded control is the bronze-beetle (Fig. 1). This insect occurs in most parts of the Dominion, but not in all districts is it outstanding as a detrimental factor in fruitgrowing. Where it has become a pest it is conspicuous mainly for its damage to developing apples, though several other plants are attached — *e.g.*, pear, plum, peach, gooseberry, black - currant, raspberry, and blackberry.

Normally the bronze-beetle is a foliage-feeder, attacking the leaf in such a way that small shot-like holes are eaten through the lamina (Figs. 7 and 8). However, the chief damage is caused by the beetle eating patches from the epidermis and underlying tissue of developing fruit, mainly the apple, which, though not actually affecting the eating-quality as a rule, reduces the export value of the crop to a degree varying with the extent of damage to each individual apple.

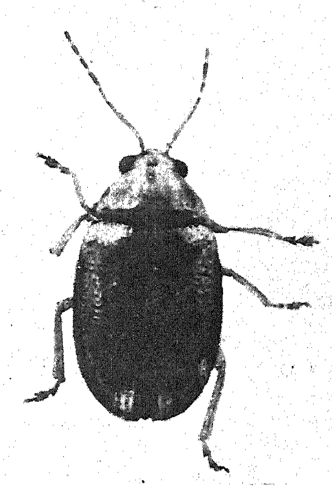

FIG. 1. BRONZE-BEETLE. × 9.

[*Photo by E. B. Levy.*

The beetle attacks the apple most frequently in the vicinity of the stalk, or sometimes the stalk itself ; and even the young bark at times is devoured from growing shoots. But the general surface of the apple is subject to attack, especially where clusters of fruit occur. Mr. J. H. Kidd, of Greytown,* states that when the bronze-beetle was excessively abundant one season the epidermis of the apple was not only eaten, but the fruit in many cases was devoured to the core.

Though the beetles may attack singly, it often happens that a number congregate at one spot, resulting in larger or smaller irregular areas of the apple-surface being damaged. In the case of very young fruit the smaller wounds may heal over (Fig. 3), leaving but little blemish on the mature fruit. Too frequently, however, the wounds do not heal over evenly, or, if they do, a scab-like patch of varying

* Mr. Kidd has rendered most valuable assistance in the experiments to control bronze-beetle, and has also given important information based on his observations of this insect over a number of years. We are also indebted to him for placing his trees at our disposal for experimental purposes.

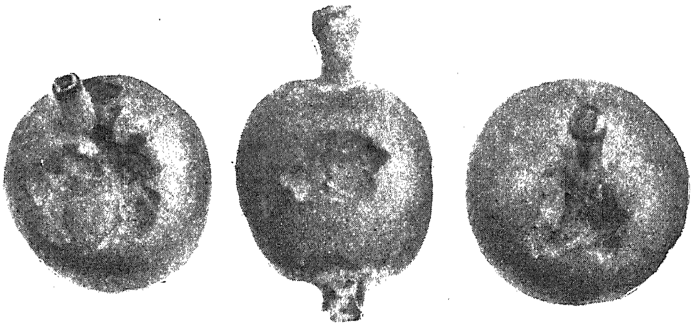

FIG. 2. YOUNG APPLES SHOWING CHARACTERISTIC DAMAGE BY BRONZE-BEETLE.

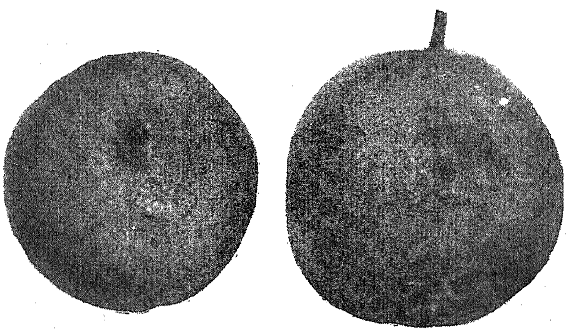

FIG. 3. YOUNG APPLES DAMAGED BY BRONZE-BEETLE, SHOWING THE WOUNDS HEALED.

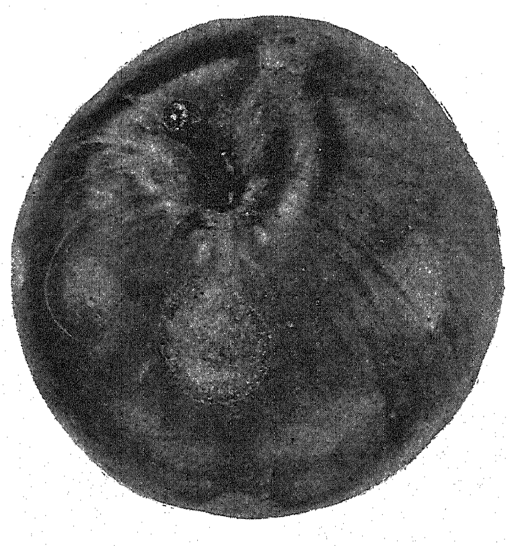

FIG. 4. MATURE APPLE WITH WOUNDS CAUSED BY BRONZE-BEETLE HEALED OVER.

[*Photos by H. Drake.*

size remains on the surface. Another characteristic result of bronze-beetle injury is malformation. This may take the form of a small scabby nodule projecting from the surface of the apple at the point of damage, or the whole side of the fruit may grow out abnormally, destroying its symmetry (Figs. 5 and 6). In some cases pronounced fissures separate the nodules when the apple has been attacked at more than one place.

Regarding the varieties of apples attacked, there seems to be a considerable difference. At Greytown, Cox's Orange and Ribston Pippin were the most severely damaged, and Gravenstein slightly so, while Delicious and Sturmer were remarkably free of injury. The clustering of apples, as in the case of Cox's Orange, has probably a good deal to do with this variety being so severely attacked, since the beetles prefer sheltered locations while feeding. This point was especially noticeable at Greytown, the beetles being not only most abundant among clustering apples, but also on the leeward side of trees during strong winds.

Concerning the life-history of the bronze-beetle but little is as yet known. This insect, like the brown or chafer beetle (*Odontria zealandica*), is mostly active over a comparatively short period during November and December of each year. Mr. Kidd, during 1924, observed the first beetles on 26th October, but in the following season (1925) they were not noticed until the first week of November, reaching a maximum between the 20th and 30th of that month. During the first week of December, when the control experiments here recorded were carried out, the beetles, though past their maximum, were still extremely abundant. Toward the close of the year the numbers become less, and only a few are on the wing early in January.

Regarding the longevity of the beetles it is of interest to note that specimens captured on 4th December lived in the Laboratory until the 30th of the month. Thus the life of the beetle may extend over a period of about one month, giving some indication of what takes place under natural conditions.

A characteristic of the bronze-beetle is its flea-like leaping habit, and the ease with which it will drop to the ground when the trees are jarred. On returning to a tree the beetles very often move along the ground toward the bole before flying up.

There is no doubt that the larvæ live in the ground, feeding on plant-roots, though no larvæ have been as yet definitely located in the field. In one place where the beetles are particularly prevalent on the trees each year, larvæ, certainly of the same group to which the bronze-beetle belongs, were dug up from among grass-roots during June, but could not be reared to maturity. In the Laboratory, beetles have laid their eggs in soil, and larvæ have hatched out but died after a few days. In the field, beetles drop from the trees and bury themselves beneath particles of soil, but, though many were followed, no actual egg-laying was witnessed. Around the base of beetle-infested trees a great number of the insects are to be found thus buried.

CONTROL.

A factor that apparently has some effect in checking the bronze-beetle is cultivation of the orchard. This is borne out by the fact

that the larvæ live underground. Mr. Kidd found that when an orchard was uncultivated, so that grass and weeds covered the ground, the beetles were extremely abundant, and apples were eaten

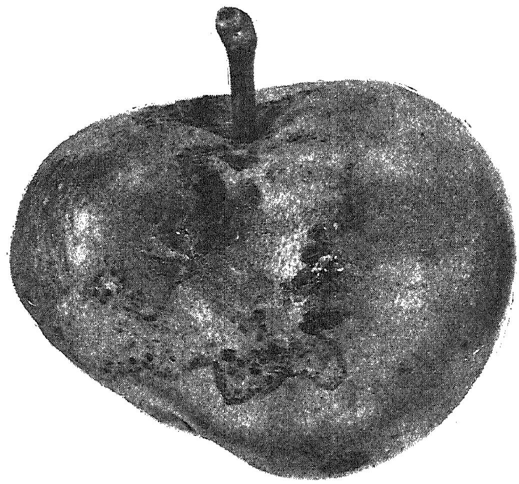

FIG. 5. MATURE APPLE SHOWING SCABBY APPEARANCE AND MALFORMATION RESULTING FROM BRONZE-BEETLE ATTACK ON IMMATURE FRUIT.

FIG. 6. MATURE APPLE SHOWING RESULT OF SEVERE DAMAGE BY BRONZE-BEETLE.

[*Photos by H. Drake.*

to the core as mentioned. Even gooseberries were so badly attacked that they had to be sorted after picking. Thorough cultivation was instituted, however, and each season, as the orchard became properly worked, the beetle infestation gradually lessened.

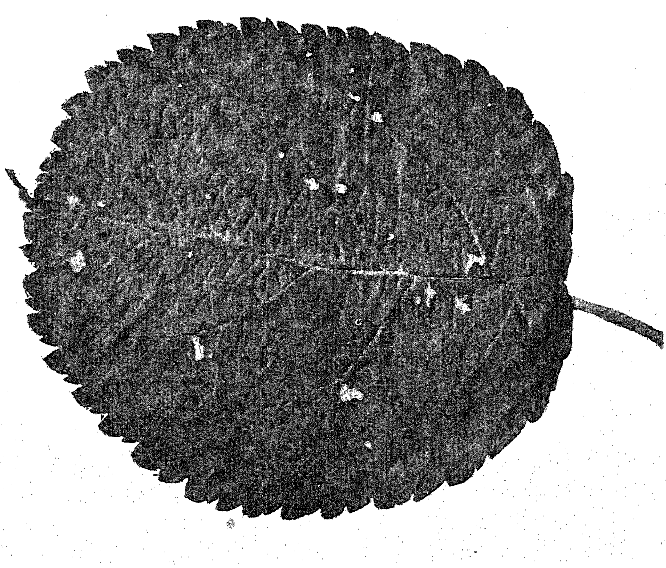

FIG. 7. APPLE-LEAF ATTACKED BY BRONZE-BEETLE.

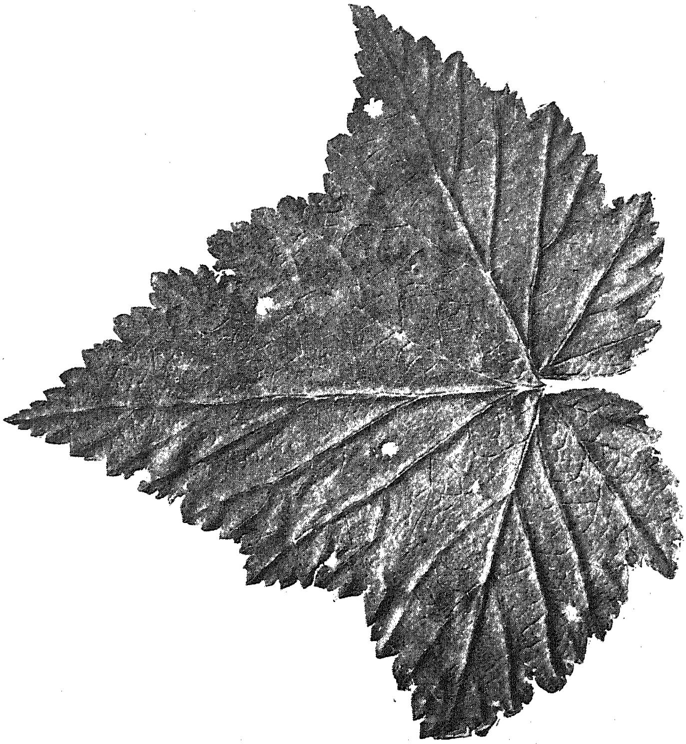

FIG. 8. BLACK-CURRANT LEAF SHOWING BRONZE-BEETLE ATTACK.

[Photos by H. Drake.

Regarding insecticides, since lead arsenate has so far proved ineffective as a satisfactory means of control, it was decided to try dusting with calcium-cyanide dust, "Cyanogas Calcium Cyanide A Dust," manufactured by the American Cyanamid Company, being used. Atmospheric moisture and the cyanide interact, resulting in the evolution of hydrocyanic-acid gas.

The dusting was carried out in the open air, the trees not being enclosed in tents. The weather conditions at the time were far from ideal on account of strong winds and intermittent showers; but the results of the experiments show that there is every possibility of dusting with cyanide being a means of controlling the beetle.

With the dust an equal quantity of air-slaked lime was mixed as a carrier. An amount of 1 lb. of cyanide was applied to each tree, the trees being 18 ft. apart both ways, and 10 ft. high. A large sheet of sacking was spread on the ground beneath each tree as it was treated, so that when the beetles fell they were easily observed.

The gas liberated from the cyanide caused the beetles to fall stupefied a few seconds after application, but it was found that though many died a considerable number recovered and returned to the tree. To overcome this, three-quarters of the cyanide was blown on the tree and the remainder on the ground immediately beneath. This proved effective, and the stupefied beetles on dropping were unable to recover, being killed by the gas liberated from the cyanide applied to the ground.

It was found that approximately 75 per cent. of the beetles on each tree treated were killed. To arrive at this percentage counts were made of the dead beetles on the sheet. These were then removed and the main limbs of the tree shaken, so that most of the living beetles remaining dropped, together with a number of dead ones which had not fallen during the application of the dust. The dead beetles were discarded and only the living counted, since it was found that a proportion of living beetles would still remain on each tree. The 75-per-cent. kill was remarkably constant for each experiment.

Under ideal conditions of calm weather there is no doubt that the percentage of control would have been much higher. Though the experiments were carried out under the lee of shelter-belts, there was sufficient wind to disperse a considerable portion of the dust. The weather had been showery, though the trees were dry at the time of dust application. The temperature was 66° F.

During the experiments it was found that the best results were secured when the dust was blown on to the apples, especially clusters, since it is there that the beetles mostly congregate.

Apart from the control of bronze-beetle, the experiments showed the possibilities of calcium-cyanide dust as a general insecticide. For example, the control of apple-leaf-hopper was very close to 100 per cent., as near as could be reckoned. These leaf-hoppers dropped dead immediately the dust was applied. The effect upon aphids was also very pronounced, but in this case the best results were secured when the dust came in actual contact with the insects.

Further experiments are being carried out and will be recorded in due course.

LUCERNE-GROWING.

NOTES FOR CANTERBURY AND NORTH OTAGO CONDITIONS.

F. E. WARD, H.D.A., Instructor in Agriculture, Christchurch.

LUCERNE was introduced into New Zealand fairly early in the history of white settlement, and, although its use did not increase rapidly, since that time it has been gradually finding its place in the economic management of farms under varying soil and climatic conditions. So far as Canterbury is concerned, it is becoming recognized that the lightness of the rainfall must in many cases be a deciding factor as to the wisdom or otherwise of accepting lucerne as a regular farm-crop. In many parts of the district, however, it may be strongly recommended.

SOILS AND METHODS OF ESTABLISHMENT.

The ideal soil for lucerne may be described as a deep, rich, silty loam, though certain other types of soil have also proved their suitability for producing heavy crops. Limestone situations, and even medium-quality soils adjacent to moving underground water, have proved suitable. Three factors which aid considerably in heavy production are sunshine, shelter, and moisture. With these conditions many of our dairying districts will produce satisfactory crops. Many localities, such as the Waikari and Oamaru districts, have soils eminently suited to lucerne-growing on account of their high lime content, while certain of the better soils on the banks of our Canterbury rivers can be turned to good account owing to the presence of moving water at a depth varying from 6 ft. to 20 ft. It is regrettable to find that in many limestone situations green-feed crops such as oats are sown for sheep when lucerne would supply the need far more effectively and at considerably less cost so far as cultivation is concerned.

Under conditions such as these, where the growing of lucerne is an easy matter, the close-rowed system should be adopted. The old practice of broadcasting is giving way to the sowing through every coulter of the seed-drill (7 in. rows), as this method has many advantages over the other. No matter how well lucerne appears to do, it is necessary every now and again to give surface cultivation, and it is possible with narrow-pointed tines to cultivate between 7 in. drills with most of our rigid-tined cultivators. The rows are sufficiently close to enable a complete smothering of weeds to be effected, while retaining the advantage of cultivation without injury to the plants. Moreover, by drilling instead of broadcasting the seed it is possible to plant the seeds at a more uniform depth and therefore ensure a more even strike. If the soil conditions are good this system of growing produces a fine-stemmed plant suitable to the making of first-class hay. It also makes harvesting operations considerably easier than under the wide-rowed system.

FIG. 1. A GOOD CLOSE-DRILLED STAND OF LUCERNE IN CANTERBURY.

Rich, sheltered land of this type, or good limestone country, produces heavy crops under the 7 in. or broadcast systems.

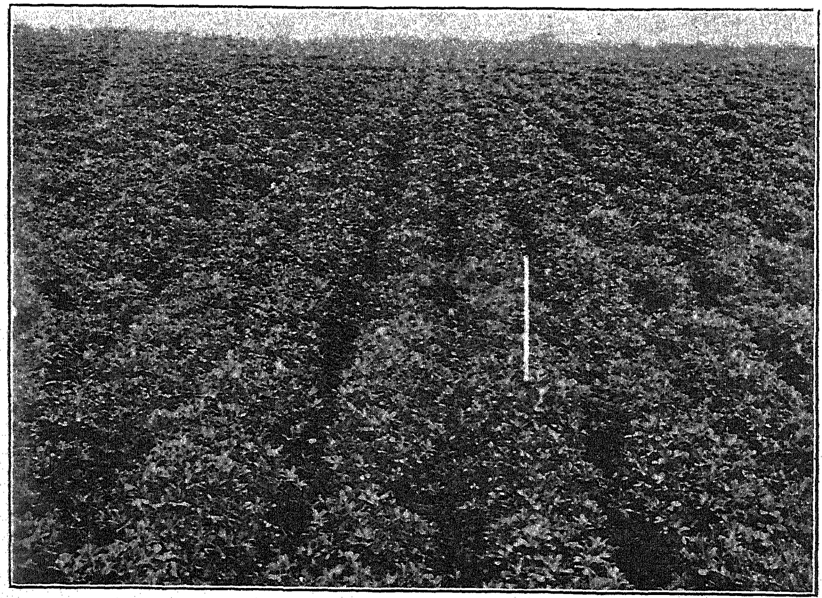

FIG. 2. A GOOD STAND OF 14 IN. ROWED LUCERNE ON MEDIUM SOIL IN CANTERBURY.

An excellent stand for grazing.

There are certain plants which indicate the suitability of soils for lucerne-growing. Among the commonest of these in New Zealand are English trefoil or black medick (*Medicago lupulina*), burr clover (*Medicago denticulata*), spotted burr clover (*Medicago maculata*), King Island melilot (*Melilotus officinalis*), and American sweet clover (*Melilotus alba*). Where these plants are growing naturally it is practically certain that the 7-in.-drill system of lucerne-growing can be followed with safety.

An early contention was that lucerne-growing should be confined to hay-production, but experience has shown that much of the hill country in suitable districts, such as the lime-bearing areas of north Otago and the Omihi Valley, could be sown with advantage and used for grazing purposes.

On certain light lands in Canterbury lucerne has been quite successful for grazing purposes under the narrow-drilled system, but in all cases the land has been near moving water, and in most cases near streams which either find their origin in or pass through limestone country. Two of the most successful of these stands have been near lime-bearing streams at Hawarden and on the banks of the Waipara River.

The economy of sowing lucerne on the light lands of Canterbury has frequently been discussed, and it seems conclusively proved that on light land, with water at a great depth from the surface, although lucerne can be made to grow, the yields are light, and the costs of preparation and maintenance are not commensurate with the returns therefrom. If, however, a farmer requires lucerne for any special purpose on such land, the wide-rowed system of 14 in. drills should be resorted to, experiments having shown that such drills are wide enough for all necessary cultural operations. It is quite practicable to intercultivate 14 in. rows, using three tines between the rows. This is regularly done by spacing two tines to run on either side and close up to the lucerne, and the third in the centre of the row at the front; banking or ridging is thereby avoided.

Lucerne undoubtedly is a deep-rooted plant, and records of roots reaching to a depth of from 20 ft. to 30 ft. are not uncommon, but as the plant feeds almost entirely near the surface the absence of surface moisture reflects itself in light growth of the crop. It is very marked that under Canterbury conditions lucerne on light land fails to make satisfactory growth during dry weather, but should there be rainfall wetting the surface to a depth of only the first 3 in. or 4 in. there is an immediate response in the growth of the plants. This shows very clearly the need for moisture comparatively near the surface if lucerne is to be successful on our light plains soil. On certain areas such as the Prison Farm, Paparua, light lands have been turned to good account, but not without a large expenditure in lime and labour. The Department's efforts to grow lucerne on the light plains land is represented by the Bankside railway area, the result of which has not induced surrounding farmers to do likewise.

The sowing in wide drills necessitates frequent cultivation to keep grasses in check, whereas the luxuriant growth and shade produced by the narrow-rowed system is sufficient in itself to keep down grasses and weeds. A certain effort was made in Canterbury several years

ago to establish lucerne in wide drills and later to sow the interspaces with useful English grasses. It was found, however, that under the poorer soil conditions the lucerne rapidly went back when in competition with grasses and when cultivation was neglected. In many of the damper districts of New Zealand where grasses and clovers grow profusely the economy of trying to establish lucerne instead of these other valuable plants is questionable.

PREPARATION OF THE LAND.

Land intended for lucerne should be well prepared, receiving at least two ploughings and sufficient cultivation to eradicate completely all weeds of a twitchy nature. Some costly failures have come under

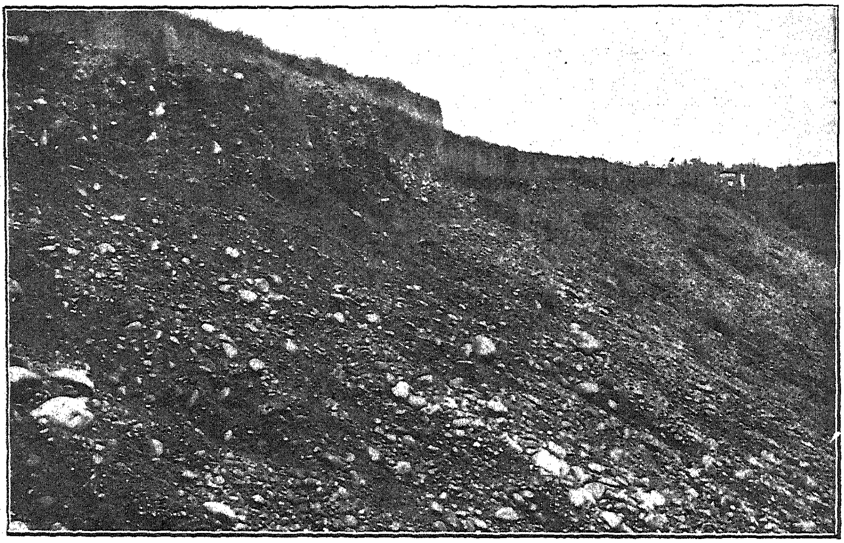

FIG. 3. TYPICAL LIGHT PLAINS LAND IN CANTERBURY.

Too light in quality and deficient in moisture for profitable lucerne-growing.

notice in which attempts have been made to sow lucerne on the one furrow out of tussock grassland. Owing to lack of consolidation and satisfactory movement of soil-moisture the plants have turned yellow and the stands have been a failure. The land should be prepared some time before date of sowing, so as to allow consolidation to take place, as lucerne likes a fine, firm seed-bed. When the surface soil is worked to a fine tilth the seed can be drilled in, and sufficient soil will fall in behind the coulters to cover the seed without the use of any other implement. The shallow sowing of seed is very important. Rolling before sowing is an advantage, as it firms the land and gives an even surface on which to drill.

LIMING.

In most cases liming is to be recommended. It is to a limited extent beneficial to the plant as a plant-food, but is most useful as a

sweetening agent in the soil. It makes possible the development of bacterial activity so necessary to the healthy growth of the plant. Ground burnt lime is usually cheaper per unit and more efficacious under Canterbury conditions than carbonate of lime, and applications of from ½ ton to 1 ton per acre may be made during the final cultivation of the land prior to sowing.

It has been interesting to note that in certain districts, such as on the downs near Timaru, liming has not appeared to be beneficial to the lucerne crop in any way. A more intimate knowledge of our soils will be necessary before we can determine which districts are lime-requirers and which will grow lucerne without liming. Until this information is available the matter must be experimented with by the farmer himself.

INOCULATION.

In districts of known high lime content it is seldom necessary to use inoculated soil, but on many areas it is a decided advantage prior to sowing to dress the soil with from 2 cwt. to 3 cwt. per acre of such soil. This should be harrowed in on a dull day. In taking inoculated soil from an old lucerne stand with the crop in rows the soil should be cut out close to the plants on either side of the row, and taken along each to a depth of 6 in. from the surface. If it is taken from a broadcast stand the surface vegetation should be chopped away and the soil removed to a depth of from 6 in. to 9 in. It should be first ascertained, of course, if the crop from which the inoculated soil is being taken is producing lucerne-roots well covered with nodules.

An area on the Ashburton Experimental Farm was sown to lucerne without inoculation. The lucerne-seed contained a certain amount of red clover as an impurity. It was found later that the clover-plants developed a rich healthy green colour, whereas the lucerne-plants were yellow and sickly, thus illustrating the point that the organism necessary to the development of nodules on clover (as distinguished from the medicks and melilots) does not operate in the formation of nodules on lucerne, and that where inoculation is necessary this must be effected by means of soil from a lucerne stand or pure cultures.

The treatment of lucerne-seed with pure cultures has become a very general practice in America. It has been only partly successful here, possibly due to the fact that the cultures are made in America and are frequently lacking in vitality by the time they reach this country.

SOWING.

If the land has been prepared early and is in good condition, sowing may be done in Canterbury as early as the end of September and may be continued to the end of February.

For sowing under the 7-in.-drill system from 10 lb. to 12 lb. of seed per acre is required on well-prepared land. For 14 in. drills from 6 lb. to 8 lb. is sufficient. As much seed is lost by being buried too deep, heavier applications than this have been advocated in the past. On the average soil a covering from ¼ in. to ½ in. is quite sufficient, and even on sandy soils it should not exceed 1 in.

VARIETIES.

Many varieties of lucerne have been tried in New Zealand, but so far none has suited our conditions better than the Marlborough. Certain varieties, such as South African, French Provence, and Hunter River, have done well, while Indian has been a rapid grower, giving an extra cut per season, but lacking the density and consequently the weight of our local product. Grimm lucerne is by no means a pure strain, and commercial Grimm seed contains a great mixture of types. In tests conducted by the Department of Agriculture and sowings made on many farms in Canterbury this variety —which was developed primarily as a frost-resister—has not proved suitable to our conditions. It is winter-dormant, and is the first variety to go off in the autumn and the last to come into production in the spring.

FIG. 4. SHOWING EFFECT OF MANURING ON LUCERNE.

Trial at Ashburton Experimental Farm: On left, unmanured rows; on right, rows manured with 2 cwt. super per acre. Sown in March, 1921; photo taken in following September. In the subsequent cuttings of the season the manured lucerne yielded about 75 per cent. more in weight than the unmanured.

MANURING.

There is no doubt as to the wisdom of applying phosphates to New Zealand soils in lucerne-growing. Superphosphate, at the rate of 2 cwt. per acre, at the time of sowing is to be strongly recommended, as it stimulates the rapid development of the plant and enables it to compete with weeds which almost inevitably come at the time of sowing. In certain districts top-dressing with super every few years at the rate of 2 cwt. per acre is a decided advantage. Lucerne stands sown with or without manure have shown a marked difference in favour of manure for three years following the application, and in the first year the crop has been practically doubled.

MANAGEMENT OF THE CROP.

The first growth of lucerne after sowing should be allowed to come almost to the flowering stage before cutting, as this assists in the development of the root-system and gives the plant a better chance of competing with weeds subsequently. The old recommendation of cutting when a few inches high and allowing the crop to remain on the ground as a mulch can no longer be upheld. The presence during the first season of fat-hen or other annual weeds should not unduly deter the grower. It is preferable to let the lucerne grow with the weeds and to cut according to the growth of the former. This practice gives the lucerne every chance of overcoming weed troubles in subsequent cuts.

After the initial growth the time for cutting must be determined by a close inspection of the crop. When the new shoots are coming away from the crown and are about 1 in. in length the crop should be cut. The flowering stage is a poor indication as to the time for cutting, because in the spring the crop is ready long before any sign of flowers appears, whereas the summer crop is probably ready for cutting simultaneously with the appearance of the first flowers. Analysis has shown that lucerne before flowering contains the highest quantity of protein. Under Canterbury conditions if left till flowering it is found that the quality of the hay suffers owing to the hardening of the stem and the loss of leaves; consequently earlier cutting is desirable.

Where lucerne is required for grazing it may be stocked when 9 in. to 1 ft. in height. The field should be closed till the crop is well grown, and then stocked heavily enough to eat it off in from a fortnight to three weeks, the stock then being removed. The impression that lucerne will not stand grazing has arisen from the fact that it will not tolerate constant nibbling. The system of 14 in. rows has an advantage for grazing in that the sheep walk between the rows and the lucerne is thus kept much cleaner.

The stock-carrying capacity of lucerne in the spring months is astonishing. On the Ashburton Experimental Farm lucerne in the spring of 1924 was grazed from 21st August onwards, and in the spring of 1925—a much later one—stocking began on 11th September. During the latter season 9 acres were subdivided into three blocks of 3 acres each. Each block was stocked consecutively with 120 hoggets —that is, forty hoggets per acre were fed on the block. Considering the total area (9 acres) grazed, the lucerne carried over thirteen hoggets per acre for twelve weeks continuously from 11th September. At the end of November rain fell, with a resulting increase in growth of the lucerne, and the stocking had to be increased to keep pace with this.

Grazing obviously consolidates the ground, and the free use of the cultivator must follow. Summer cultivation is not essential, but deep and thorough autumn cultivation is most strongly recommended. This leaves the ground in a rough condition during the winter, enabling the frost to act upon it, and then, with the aid of the tine harrows, a fine free surface can be obtained for the following season. Where the land has become too consolidated for grubbing, the disks, without any " set " on them, can be used to assist cultivation. Ordinary disking with the idea of cultivating the ground should, however, be avoided. It has been astonishing to find how much autumn

FIG. 5. LUCERNE AREA AT ASHBURTON EXPERIMENTAL FARM USED FOR GRAZING.

This area (a 21-in.-rowed stand) was heavily grazed three times with sheep between September and December last. The photo was taken on 24th December, and shows a growth of fourteen days since the last grazing. The lucerne area beyond the fence, on right, is seen closed for hay.

FIG. 6. SHEEP AND LAMBS GRAZING WIDE-ROWED LUCERNE AT ASHBURTON EXPERIMENTAL FARM.

cultivation can be given to stands in limestone areas without injury to the crop. Stands which the writer has seen cultivated so as to appear almost like ploughed fields have in the spring shown most prolific growth. (See Figs. 7 and 8.)

Land which has become consolidated or dirty with weeds has on occasions been skim-ploughed with satisfactory immediate results; but further observations have shown the practice to be undesirable, as considerable injury is done to the plants by cutting.

HAYMAKING.

In order to conserve the maximum amount of leaf and to retain the pliable stem, lucerne should not be allowed to dry too rapidly in the field. Management at harvest-time must, of course, depend upon weather conditions, but where a fairly dry climate prevails, the lucerne can be cut in the morning, allowed to wilt till the afternoon, and then be raked into windrows. If the weather is very drying it may be necessary to put the lucerne up into cocks so as to avoid drying taking place too rapidly. If large cocks are made it will be necessary to turn them once or twice in order to get even drying. Under normal Canterbury conditions a lucerne crop can be completely harvested in from seven to ten days. As lucerne hay absorbs water very rapidly the stack should be kept as high as possible in the middle, and when finished should be thatched or covered with a layer of straw. Lucerne should be stacked on the green side. If heating takes place in the stack the quality of the hay from the feeding point of view will not be greatly impaired. An endeavour should be made to obtain hay of a bright green and non-brittle nature.

In districts where frequent rainfall prevents the rapid making of hay the crop may be turned into silage. Owing, however, to the highly nitrogenous nature of lucerne and its great succulence it does not rank among the best crops for silage-making, though by the mixture of meadow hay or some coarser fodder it is much improved.

UTILIZATION.

The most important place that lucerne takes on the farm is in the providing of high-class hay for winter feeding, and on those soils where it can be grown easily it ranks first for this purpose. If, however, there is difficulty in procuring a satisfactory yield from the spring cut the farmer may be wiser to use short-rotation pastures of rye-grass and red clover as his main source of winter hay. Another eminently suitable crop is a mixture of autumn-sown oats and vetches, its production per acre being heavier than any other which can be grown for this purpose. Lucerne hay, however, excels the hay of either of these two crops, good and relished by stock as they may be.

It is not an easy matter to chaff lucerne, but where this can be done it makes an excellent winter feed for ewes. Grassland on the Ashburton Experimental Farm was stocked throughout the winter from May till August at the rate of ten ewes to the acre, and these were fed with lucerne chaff, consuming about 2 lb. per head per day.

They wintered excellently, and in the spring the adjoining lucerne-paddock fattened the lambs. Green lucerne is a great milk-producer for the ewes, and it enables the farmer to get the lambs fat off the mothers, and thus avoid to a large extent the need for rape. The ewes in question with their lambs were turned on to the lucerne, and in three months the lambs were sold fat off their mothers in December, 1924, for the high price of 46s. per head.

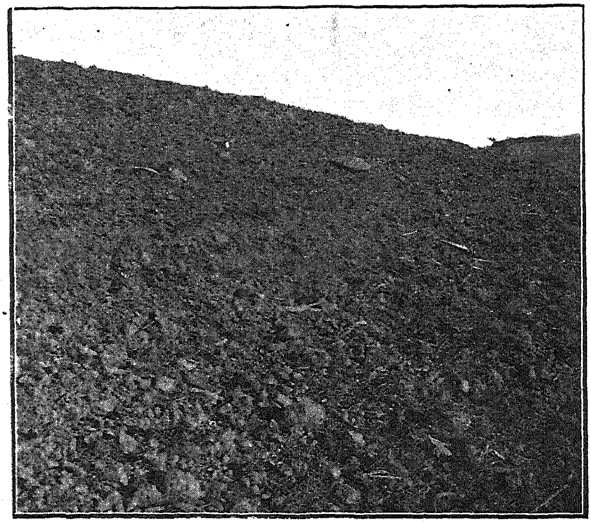

FIG. 7. LUCERNE STAND ON HILLY LIMESTONE COUNTRY IN NORTH OTAGO AS IT APPEARED IN JULY AFTER VERY SEVERE WINTER CULTIVATION.

FIG. 8. PROLIFIC SPRING GROWTH ON THE SAME AREA AS SHOWN IN FIG. 7. PHOTO TAKEN IN NOVEMBER OF THE SAME YEAR.

When it is fully realized what an important part lucerne can play in the management of the sheep-farm its popularity will no doubt further increase. The sheep-farmer usually objects to cutting hay three or four times a year, but when he realizes that a good spring cut will provide all the winter hay that is required, and that the remainder of the season's growth can be utilized for grazing, the crop will be viewed with increasing favour.

IRRIGATION.

Lucerne responds remarkably to irrigation, and many of our drier areas with comparatively poor soil conditions could be made to grow the crop successfully with this aid. As, however, the subject was recently dealt with fully in a special series of articles on "Irrigation" published in the *Journal* it will not be further treated here.

DISEASES.

Lucerne is a crop almost immune from serious diseases. Leaf-spot periodically occurs and causes a certain amount of injury in that it makes the leaves fall. As a rule, however, the trouble is confined to that particular cut of hay. When that is removed subsequent crops may be perfectly healthy. Rhizoctonia is a somewhat serious disease in certain districts of higher rainfall, but in Canterbury it is practically negligible. Sclerotia disease sometimes attacks lucerne under damp conditions, but no great injury results to the stand as a rule. This trouble appears as a white mould with black fructifications on the stems of the plant close to the ground.

SOME POINTS SUMMARIZED.

(1.) On deep silty soils and on limestone country sow lucerne through every coulter of the seed-drill—7 in. rows.

(2.) On lighter country and where the lucerne is primarily intended for grazing sow in 14 in. rows.

(3.) Prepare ground early and well, and roll before sowing. Drill very lightly, and do not harrow or roll after sowing.

(4.) In most cases, a week or two before sowing, lime with from ½ ton to 1 ton of crushed burnt lime per acre.

(5.) Sow 10 lb. per acre of seed in 7 in. drills or 6 lb. to 8 lb. in 14 in. drills.

(6.) Allow the first growth after sowing to be well grown before cutting. Subsequent cuts should be made when new shoots are showing at the crown.

(7.) In haymaking do not allow the crop to dry too quickly. Cover stacks well to keep rain out.

(8.) Chaffed lucerne hay will winter ewes well. About 2 lb. per day is required.

(9.) Green lucerne is a great milk producer. A good stand will often mean fat lambs off their mothers and lessen the necessity for rape.

TESTING OF NEW-ZEALAND-GROWN WHEATS.

RESULTS FOR YEAR 1925.

(Continued.)

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III. BAKING TESTS.

EXPERIMENTAL baking tests are designed to determine the actual suitability of different flours for breadmaking. In particular such tests differentiate between those flours which, though low in protein content, yet make good loaves, and those flours which, possessing a good protein content, for one reason or another fail to produce good bread. The work carried out by the Chemistry Section in 1925 has been fairly complete, and affords an insight into the behaviour of the flours obtained from the New-Zealand-grown wheats when undergoing the practical test of baking; it also shows such correlation as exists between chemical analyses and baking tests. Some additional analytical figures, to be given in another article, will elaborate this point.

To carry out baking tests accurately and efficiently, the conditions of baking must be as nearly the same in every series of loaves as it is possible to maintain them. Even baking tests, however, are not infallible, and it is not always easy to obtain absolutely concordant results. All tests, however, are done in duplicate. If, as sometimes happens, these duplicates do not approximately agree, it is then necessary to repeat tests a third and perhaps a fourth time. From an average of such a series a fairly correct idea of the breadmaking qualities of a flour may be obtained.

The method of experimental baking is standardized as far as possible. Not only must the sugar, salt, and yeast be always of the same good quality and used in exactly the same amounts, but the mixing, doughing, proving, and baking processes must be carried out under the same conditions in every case. The only differences in treatment are the amount of water added in mixing the dough, and the length of time the dough is allowed to ferment. The amount of water added is based on the percentage absorption of water.

SIZE OF LOAF.

The size, or volume, of a loaf is a measure of the quality or strength of the flour from which it is baked. A dough will expand two to three times its original volume before it reaches its maximum expansion, the time for this depending on the quality of the flour and the activity of the yeast. In the present experimental tests the dough was allowed to reach a point just short of its maximum expansion before it was placed in the oven. It is true that in commercial baking a loaf is not allowed to ferment as long as this, but a flour which gives the best loaf under the maximum expansion of laboratory baking tests will also make a loaf of good volume and texture when baked in the ordinary commercial way.

METHODS OF EXPERIMENTAL BAKING TESTS.

A greater proportion of yeast is used in experimental baking than in commercial methods, but this is to ensure that any failure on the part of the flour to produce a good loaf is not due to the lack of yeast. Sugar is also added so that there shall be no lack of material for the yeast to work upon in the initial stages of proving.

The flour, water, yeast, salt, and sugar are warmed to 35° C. (= 95° F.), and mixed. The doughs receive as nearly as possible the same amount of kneading, and are then placed in a proving-cabinet, where the fermentation proceeds under regulated conditions of temperature (35° C.) and humidity. A definite degree of dampness must be maintained to prevent the formation of skins on the doughs, which are likely to modify expansion. The doughs are placed in well-greased tins and allowed to attain almost their maximum expansion; they are then placed in the oven, where they are baked at 220° C. (= 428° F.). The tins in which the loaves are baked are all equal in

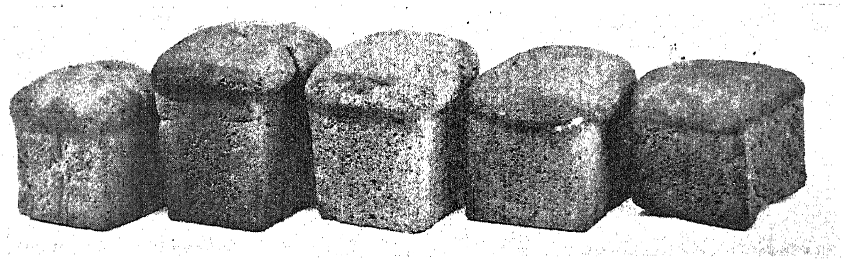


FIG. 4. SERIES OF EXPERIMENTAL LOAVES AS REMOVED FROM THE OVEN.

Loaf on extreme left baked from a commercial sample of fair average bakers' flour; the other loaves from some experimentally milled flours. Note in comparison the excellent volume of three of the latter.

[*Photo by F. T. Leighton.*

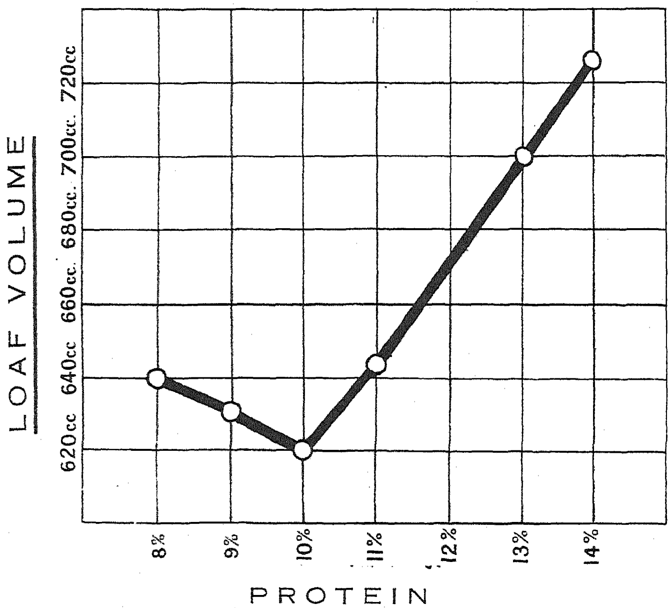
side measurements, but vary in height—namely, 2 in., 2·4 in., 2·8 in., and 3·2 in. By this variation in the height of the tins it is possible to arrange all doughs, each perhaps differing in volume from the others, with the same amount projecting, at maximum expansion, unsupported above the sides of the tins. From the shape of that portion of the unsupported loaf it is possible to obtain some idea of the strength of the flour. A dough made from a strong flour will stand up boldly; a weak dough tends to collapse and spread over the sides of the tins.

With each series of experimentally milled flours a commercial sample is included in the baking tests as a standard (see Fig. 4). The experimental flours are compared with this, as to texture, colour, &c. The commercial sample serves also as a check on the proper maintenance of conditions in doughing and proving; for if the standard flour gives the same volume each time it is baked one may assume that conditions of mixing, &c., have been the same in each series. After baking, the loaves are cooled, weighed, and their volumes measured; on the following day they are cut in halves and their texture and colour noted.

SIZE OF LOAF AND PROTEIN CONTENT.

The size of the loaf is connected, on an average, with the amount of protein the flour contains. Graph 3 shows this relationship, the average loaf-volume of the flours tested this year being plotted against the percentage of protein. To obtain these figures the flours with approximately the same amount of protein (8–9 per cent., 9–10 per cent., &c.) were classified together, and the average loaf-volumes of these classes were then determined.

It will be noticed that there was a rise in average loaf-volume for those flours containing less than 10 per cent. protein. This was apparently due to the very good *quality* of the gluten in the flours obtained from the Lake County wheats, which latter were low in protein content but made good bread.



GRAPH 3. SHOWING THE GENERAL TENDENCY OF THE LOAF-VOLUME TO INCREASE WITH INCREASING PROTEIN CONTENT.

The samples tested in 1925 provided the data upon which this graph is based. It will be noticed that below 10 per cent. protein there was an unexpected increase in loaf-volume. This reverse in the trend of the graph was perhaps due to the very good *quality* of the gluten in the Lake County flours.

NOTES ON RESULTS OF BAKING TESTS (SEE TABLE 6).

The flours from the various wheats are arranged in the same order as that adopted in Table 5 in the second article of this series (*Journal*, December, 1925, p. 381), thus enabling easy reference to be made to the chemical analyses. The percentage absorption-of-water figures are

Table 6.—Baking Tests.

Laboratory No.	Variety.	Where grown. Locality.	Where grown. County.	Absorption of Water.	Protein.	Quality of Gluten judged by Appearance.	Experimental Loaf. Shape.	Experimental Loaf. Texture.	Experimental Loaf. Colour.	Experimental Loaf. Volume.
				1924 Wheats.						
				Per Cent.	Per Cent.					C.c.
S 392	Durum	..	..	56·0	11·81	Poor	Poor	Fair	Good	440
S 709	Tuscan	Arrowtown	Lake	54·2	11·75	Fair	Good	Fairly good	..	660
S 712	,,	Gibbston	,,	53·2	9·38	Good	Fair	Good	Medium	660
S 708	,,	,,	,,	53·6	8·69	,,	Very good	Fair	Fair	700
S 711	,,	Arrowtown	,,	56·2	8·56	,,	Medium	Good	Medium	670
S 710	,,	Miller's Flat	,,	56·6	8·50	,,	Poor	,,	,,	620
S 713	Hunter's	Tarras	Vincent	50·8	7·69	,,	..	..	..	..
S 714	Velvet	Ardgour	,,	54·6	7·19	,,	Good	Good	Good	650
				1925 Wheats.						
S 774	Essex Conqueror	Ashburton	Ashburton	51·4	14·69	Medium	Good	Fair	Medium	755
S 775	Yeoman	,,	,,	48·0	14·19	Fair	,,	Fairly good	,,	700
S 769	Marquis	,,	,,	49·6	13·75	,,	,,	Good	Very good	660
S 779	Scandinavian	,,	,,	48·2	13·75	Medium	Medium	Poor	Medium	720
S 771	Velvet	,,	,,	50·0	13·56	Fair	Good	Very good	Good	700
S 772	Snowdrop	,,	,,	47·6	13·50	Medium	,,	Medium	Medium	700
S 770	White Tuscan	,,	,,	49·8	12·25	Fair	Medium	Fairly good	,,	670
S 778	Hybrid W	,,	,,	47·6	11·88	Medium	Good	Good	Good	660
S 773	Velvet Ngapara	,,	,,	50·8	11·88	Fair	,,	,,	Fair	670
T 78	Durum	Hinds	,,	51·6	11·81	Medium	Poor	Medium	,,	540
S 776	Zealand	Ashburton	,,	50·4	11·63	,,	Good	Good	Good	590
S 767	Queen Fair	,,	,,	52·8	11·31	Fair	Fair	Fairly good	,,	640
T 37	Velvet	Lincoln	Springs	50·0	11·13	,,	Good	Good	,,	650
T 50	Marquis	Gore	Southland	54·4	10·88	,,	,,	,,	,,	680
S 768	Major	Ashburton	Ashburton	50·0	10·75	,,	Medium	,,	,,	600
S 765	Jumbuck	,,	,,	60·8	10·69	,,	Good	Very good	,,	600
S 777	Red Fife	,,	,,	51·6	10·56	Good	,,	,,	,,	680
T 75	College Hunter's	,,	,,	51·4	10·31	Medium	,,	Good	,,	560
S 766	Queen Fan	,,	,,	48·8	10·31	Fair	Fair	,,	Fair	570
T 77	Solid-straw Tuscan	,,	,,	52·4	9·69	,,	,,	Medium	,,	535
T 51	Major	Gore	Southland	55·2	9·63	Medium	,,	Poor	Medium	680
T 152	Solid-straw Tuscan	,,	,,	54·4	9·44	Fair	Good	Medium	,,	640
T 76	College Velvet	Ashburton	Ashburton	51·8	9·25	,,	,,	,,	Good	630
T 101	Hybrid W	Horrelville	Eyre	49·4	8·75	Medium	,,	,,	Fair	580

C.c. = cubic centimetre; 100 c.c. = 6·25 cubic in.; 500 c.c. = 31·25 cubic in. (approx.).

BAKING TESTS.

(All figures read from left to right.)

FIG. 5.

Essex Conqueror (S 774); Scandinavian (S 779); Velvet (S 771); Snowdrop (S 772); Velvet Ngapara (S 773). All from Ashburton.

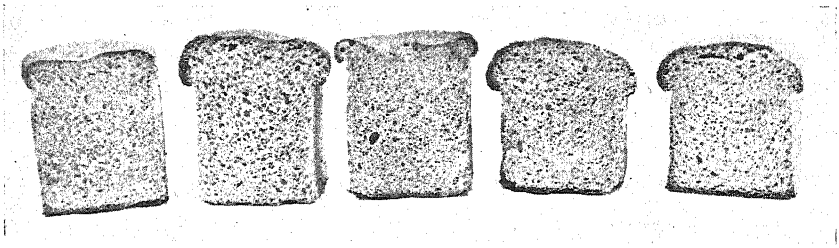


FIG. 6.

Velvet, Ashburton (S 771); Essex Conqueror, Ashburton (S 774); Yeoman, Ashburton (S 775); Red Fife, Ashburton (S 777); Hybrid W, Horrelville (T 101).

FIG. 7.

Solid-straw Tuscan, Ashburton (T 77); Durum, Hinds (T 78); Durum (S 392); Solid-straw Tuscan and Durum, blended sample; College Hunter's and Durum, blended sample.

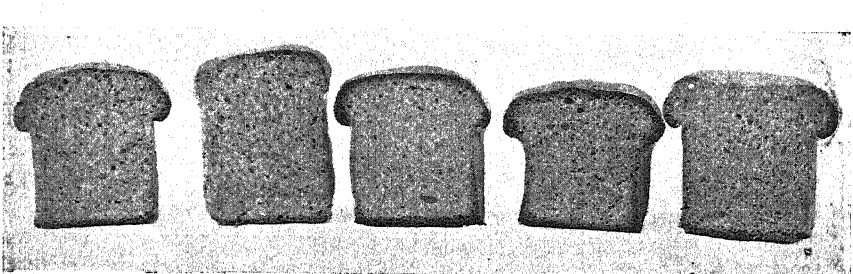


FIG. 8.

Marquis, Gore (T 50); Major, Gore (T 51); College Velvet, Ashburton (T 76); Solid-straw Tuscan, Ashburton (T 77); Velvet, Lincoln (T 37).

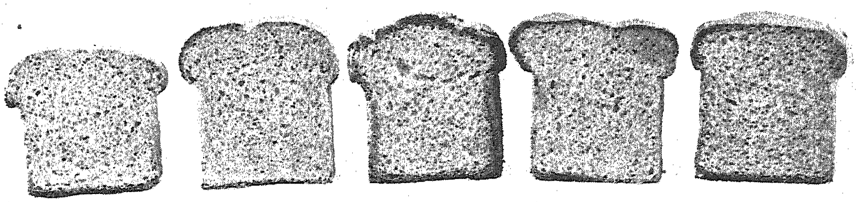


FIG. 9.

College Hunter's, Ashburton (T 75); Tuscan, Gibbston (S 708); Velvet, Ardgour (S 714); Marquis, Ashburton (S 769); Hybrid W, Ashburton (S 778).

[*Photos by F. T. Leighton.*

repeated, and also the percentage of protein; a description is given of the quality of the gluten as revealed by its appearance and cohesion, &c. The shape, texture, colour, and volume of the loaves are given in subsequent columns. The volumes of the experimental loaves may be compared with that of the standard loaf made from a good average baker's flour—namely, 600 c.c. Some of the loaves obtained in the baking tests are shown in Figs. 5, 6, 7, and 8. Each reproduction of the loaves has been reduced proportionally, so that any one loaf in the series may be compared with any other.

Varieties of Wheat-flours.

The 1924 wheats were of particular interest, including as they did the flours obtained from Lake County wheats; these Lake wheat-flours were mostly low in protein, but contained gluten above the average in quality. They produced loaves of good volume, and decidedly larger than those other flours with the same protein content received in this and previous years. S 708 (Tuscan), in particular, produced a loaf of very good volume, very good shape, and fair texture and colour; this flour compared very favourably with the best of the flours yet tested (see Fig. 9). The others from the Lake district were very little inferior to this sample.

The sample of Durum (S 392) can definitely be described as a poor breadmaking flour when used by itself (see Fig. 7); the quality of its gluten was poor, and it failed to make even a fair loaf, in spite of the good quantity of protein it contained. It might, however, prove suitable for blending with other flours.

The best of the 1925 flours was that obtained from Essex Conqueror (see Fig. 5). This flour produced a loaf of excellent volume, good shape, and fair texture, a result which would be expected from its very good protein content. Scandinavian (see Fig. 5) gave the next best loaf-volume, but the texture of the loaf was poor, discounting considerably the good volume obtained. Yeoman (Fig. 6) made an excellent loaf of good size and shape; this sample also contained a very good amount of protein of average quality. The sample of Marquis (S 769) gave a very good loaf of good shape and texture, and very good colour; one would, however, have expected this flour to produce a loaf of larger volume. Velvet

(S 771) produced a very good loaf in every respect; Snowdrop (S 772) was as good in volume, but fell off in texture and colour. White Tuscan (S 770), Hybrid W (S 778), and Velvet Ngapara (S 773) all gave good loaves. The sample of Durum from Hinds, like the Durum grown in 1924, failed to make a good loaf, though in this case it was better than S 392 (see Fig. 7). Zealand (S 776) made a medium loaf, and one not so good as its protein content would indicate. Queen Fair (S 767) and Velvet (T 37) made good loaves, the Velvet sample being good in shape, texture, and colour. Marquis (T 50), from Gore, Southland, produced a very good loaf; the quantity of the gluten in this sample was low for such a result. The sample of Major (S 768) gave a fair loaf, as did Jumbuck (S 765); but Red Fife (S 777), with a protein content not particularly high, gave a loaf of very good volume, this no doubt being due to the good quality of the gluten which it contained. College Hunter's (T 75) gave a loaf of good shape, texture, and colour, but medium in volume. Queen Fan (S 766) was a medium flour, and Solid-straw Tuscan (T 77) poor. A sample of Major (T 51), from Gore, gave a loaf of good volume; it was fairly low in protein content. Solid-straw Tuscan (T 52) from the same locality gave a fair loaf, though it, too, was fairly low in protein content. A sample of Velvet (T 76), low in protein content, gave a fair loaf. Hybrid W (T 101) was also low in protein content, and gave only a medium loaf.

Localities.

In judging the strengths of various flours by their protein content it is fair to compare only those obtained from wheats grown under more or less similar conditions. The flours from Lake County, however, stood out in these tests as being of very good strength even though they were low in protein content. There can be no doubt that their strength depended on something apart from the quantity of gluten present; the good *quality* of the gluten which they contain may have had something to do with these good baking-properties, though even here the volume of the loaf was to a limited extent dependent on the percentage of protein in the individual samples.

The samples from Gore (see Fig. 8) also produced good loaves and better than the protein content suggested; none of these, however, contained gluten above the average in quality as far as a visual inspection of the gluten showed. A fairer comparison between samples could be made with the flours obtained from Canterbury wheats. Here the order of loaf-volume was, with few exceptions, the order of the protein content. The possible exceptions were Marquis (S 769) and Zealand (S 776), which were perhaps not so good as their protein content indicated; Durum (T 78), which was decidedly poorer; and Scandinavian (S 779), Velvet (S 771), Snowdrop (S 772), and Red Fife (S 777), which were better. The gluten of these samples appeared on inspection to be average in quality, with the exception of Red Fife (S 777).

SUMMARY.

Flour milled from Essex Conqueror produced the best loaf of those varieties tested in 1925. An excellent loaf was made from Yeoman. Samples of Velvet, Marquis, and Red Fife produced very

good loaves. The Durum flours were failures in regard to their breadmaking qualities.

The order of the strength of the flours as determined by baking tests was, on an average, also the order of the protein content of the various samples. Individual protein content and loaf-volume were more closely correlated when comparing flours from wheats coming from the same wheat-growing districts. Exceptions were the flours obtained from the wheats grown in Lake County and Southland County, which generally produced better loaves than their protein content indicated. The flours from the Lake district contained gluten above the average in quality as determined by a visual inspection of the isolated gluten; these flours were milled from Tuscan wheats. Those from Southland County, however, were of average quality in this respect.

Flours from Canterbury wheats gave results in which, with some exceptions noted, the protein content was a good index to the baking-value of the different flours.

(Series to be continued.)

PROCESSED CHEESE AND THE IRISH MARKET.

THE following notes are from a recent report received by the Director of the Dairy Division from Mr. Walter Wright, New Zealand Inspector of Dairy-produce in London :—

Regarding the development of the processed-cheese trade, I find that this product has taken on remarkably well in Ireland owing to the fact that there are such large numbers of small retailers who cannot conveniently handle a full-sized 80 lb. cheese. Some of them, in fact, prefer the Australian cheese to the New Zealand owing to the fact that the former are only about half the weight.

According to information I have received both in Belfast and Dublin, these small retailers are evidently taking on very readily the " Kraft " cheese. It is now put up in 1 lb. blocks, whereas on the initiation of this trade all the blocks were 5 lb. weight. Notwithstanding that this cheese retails at 1s. 8d. in Belfast and 1s. 10d. in the south of Ireland, a considerable trade seems to be developing right throughout the country. Although the manufacturers have commenced to pack it in the 1 lb. blocks, yet retailers, I believe, in some localities prefer the 5 lb. blocks because they can be cut up conveniently into ½ lb. portions if required, which is a matter of convenience to them.

With regard to the Irish cheese trade, from what I can gather the Irish are not a great cheese-eating people. There is a certain amount of New Zealand cheese used right throughout the country, but not to the extent I would like to be able to report. I might mention in passing, however, that the Irish people like a very pale straw-coloured cheese. Several merchants whom I interviewed advised me that, although the general quality of New Zealand cheese was satisfactory to them, the colour, generally speaking, is too deep for their trade.

Condition of Cattle-dips.—During 1924–25 an examination of samples from the public cattle-dips of the tick-infested districts was undertaken by the Department's Chemist in conjunction with the Live-stock Division. It was shown that many of the dips were in an unsatisfactory state, in some cases the dipping-fluid being far below the correct strength. Arrangements were made by which samples from every dip will be sent to the Chemical Laboratory at Wellington each month during the busy season, and each alternate month during the off season.

GRAPE-WINE-MAKING IN SMALL QUANTITIES.

DIRECTIONS FOR NEW ZEALAND CONDITIONS.

J. C. Woodfin, Vine and Wine Instructor, Horticulture Division.

For wine-making on a small scale the grapes should be quite ripe; from 13 lb. to 15 lb. are required to make 1 gallon of wine. The berries should be separated from the stalks and crushed with the hands or by rubbing them through a ½-in.-mesh wire sieve.

A wooden or earthenware vessel is required for fermenting the must. On no account should a metal one be used unless it is enamelled. The fermentation vessel should be at least one-third larger than the maturing barrel, so as to allow plenty of room for the grape-skins, which will rise to the surface and form a "cap." The lees from the first racking will also reduce the volume of wine. All vessels and utensils used in making wine must be absolutely clean and sweet, and free from mould and vinegar flavours.

If it is intended to make a dry wine—that is, a wine in which all the sugar is transformed into alcohol and carbon dioxide, the escape of which into the air in the form of gas causes the boiling of the must during fermentation—add ½ lb. of sugar to each gallon of must. If a sweet wine is to be made, add 2½ lb. to 3 lb. of sugar, according to the degree of sweetness desired.

When making a dry wine the sugar should be added before fermentation sets in, and in making sweet wine when the must is being transferred from the fermenting-vessel to the storage barrel or jar. In both cases the sugar should be thoroughly dissolved by stirring.

In seasons when the grapes do not ripen well the acidity may be too high to make a palatable wine. In making wine for home use this acidity can be reduced by adding water to the must at the rate of about ⅓ gallon to each gallon of juice, and in this case 2½ lb. of sugar must be allowed for each gallon of added water in making the dry wine, and 4 lb. when making sweet wine. The acidity should not, however, be reduced too much, or the resulting wine will prove flat and insipid, and will not keep well.

Fermentation will set in spontaneously in a day or two in a favourable temperature, which ranges about 65° F. If the weather is cold the must can be heated to 90°, and the vessel covered with a sack or some other suitable covering to keep the heat in, when fermentation will generally set in. The temperature of the must when fermenting should be from 80° to 85°. If it rises too high or sinks too low fermentation will slow down, and may stop eventually. The "cap" of grape-skins should be pushed down into the must, and the whole stirred up at least twice a day while fermentation is going on.

In the case of dry wine the must should remain in the fermenting-vessel until fermentation has apparently stopped and the skins commence to sink into the wine. The wine can then be siphoned off or run off through a tap into a storage cask, and placed in a cool cellar, where a slow fermentation will continue for some time. The skins should be pressed or wrung in a piece of hessian or some fairly open

material—previously boiled to sweeten it—and the wine extracted added to the bulk.

When making sweet wine the must can be separated from the skins after three or four days' fermentation, and, after mixing with sugar, run into a storage cask to continue its fermentation. There will be no need to store this in a cool cellar, as it will mature much quicker in a warmer temperature.

A slow fermentation will continue in the dry wine for a month or two, and in the sweet wine much longer, the exact period depending principally on the amount of added sugar. Gas will be produced as long as fermentation continues, and may cause the container to burst if it is tightly bunged. A good plan is to cover the bung-hole with a small bag of clean sand ; this will keep out the air and flies, and at the same time allow the gas to escape. When used to cover the bung-holes of the barrels of fermenting dry wines or cider, these bags retain in the barrel some of the gas formed in the process of fermentation, and at the same time keep out the air, a condition unfavourable to the development of the dreaded vinegar bacteria. The container should be bunged tightly when the sizzling noise produced by the escaping gas-bubbles ceases.

At this period, when the wine has become fairly clear, it should be racked or separated from the lees. This can be accomplished by inserting a wooden tap in the barrel above the lees, or by siphoning the wine out with a rubber tube tied to a piece of cane so that the end of the tube will be a few inches from the end of the cane and above the lees in the container. Dry wine is usually racked after fermentation and at the end of the winter, twice during the following twelve months, and once or twice in subsequent years. Whenever possible cold bright weather should be chosen to perform the operation. Sweet wine is racked twice the first year and once during subsequent years, until it is quite clear and bright.

During the maturing-period of dry wines the barrels must be filled up regularly from small vessels of wine kept for the purpose to replace the wine which evaporates through the wood. If an air-space is left mould will form on the surface of the wine and will probably cause the wine to turn sour. Air on the surface of sweet wines will not have the same consequence.

Dry wines can be bottled after the first or second winter, but sweet wine should remain in the wood at least three years, and will improve if kept longer. The rubber tube used for racking can be used for bottling the wine. If it is too thick to enter the neck of the bottles a smaller tube can be inserted in the end of it, or tubing $\frac{3}{8}$ in. interior measure, such as is used for connecting gas-rings, would be suitable both for racking (on a small scale) and bottling. The bottles when filled should be kept on their sides in a cool cellar for six months before being consumed, so as to allow the wine to recover from what is known as "bottle sickness."

Where it is intended to make a large quantity of wine a Baumé hydrometer will be found useful for obtaining the exact density of the fruit-juice, for ascertaining the right amount of sugar to add when necessary, and for following the progress of the fermentation. Notes on the use of this instrument were published in the *Journal* of July last.

HORTICULTURAL EDUCATION FOR NEW ZEALAND.

INSTITUTE OF HORTICULTURE REPORT.

Report by a special committee of the New Zealand Institute of Horticulture—Dr. L. COCKAYNE, Mr. P. BLACK, and Professor H. B. KIRK—presented to the annual meeting of the Institute, 1925.

IT is impossible to overestimate the importance of horticulture to any nation, so interwoven is it into the lives of the people. Consider how it concerns not only an essential and very large part of the food-supply, but that from the æsthetic standpoint it is pre-eminent. The gardener, both professional and amateur, is indispensable to our well-being.

Nothing can be clearer than the fact that the best horticultural education procurable should be provided for those proposing to take up horticulture as a profession. But such education should go further than that, and suitable horticultural instruction should be given first in both the primary and secondary schools, and afterwards it should still continue, though working silently, by means of properly equipped botanic gardens, spacious parks, cities adorned with trees and flowers, popular horticultural writings in the newspapers, a journal devoted to gardening in all its branches, standard works and periodicals in the libraries, horticultural exhibitions, popular lectures, and so on. Finally, the goal, so far as New Zealand is concerned, is the development of a true national horticulture, worthy of the soil and the climate, and not a mere imitation of that of other lands.

This report does not go into details connected with education; such can come later. It is rather an attempt to bring together some of the principles by which we think the foregoing ideals might come to pass; but specially do we seek to put forth a practicable plan whereby the necessary training for gardeners can be provided, or, at any rate, a foundation be laid upon which, by degrees, to raise a satisfactory educational edifice.

At the present time there is in New Zealand no distinction between a gardener who is well versed in his profession and one altogether untrained who probably knows little, if anything, concerning horticulture. Nor has the public any idea what vast, many-sided knowledge is required by a really high-class horticulturist—knowledge in no whit less than in that of any of the learned professions.

To begin with, apart from horticulture proper, a fair knowledge of chemistry, meteorology, soil-science, entomology, and surveying is required, while botany demands particular attention from the physiological, structural, mycological, ecological, and systematic standpoints. Then, on the purely horticultural side a thorough knowledge is demanded of the cultivation of fruits, vegetables, and flowering-plants of all kinds (trees, shrubs, herbaceous and bulbous plants and annuals); there is gardening under glass (the coolhouse and the stove), and that of the open-air, with its many side branches, to cite from the flower-garden alone — lawns, hedges, plantations, the shrubbery, the herbaceous

border, the alpine garden, bedding-out, the rose-garden, florists' flowers, the pergola, flowers for exhibition, the water-garden. Then comes that highly skilled work the propagation of all kinds of plants, and with this there is the science of plant-breeding. There is orchard-work and all pertaining thereto; there is a close knowledge of garden pests and the means to avoid or combat such; there is landscape gardening; and there are the manifold business aspects of horticulture. Finally, though leaving much unsaid, the high-class gardener has to keep abreast of the times by reading the new literature constantly appearing.

The above is no exaggeration; it underrates rather than overstates the requirements in the domain of horticulture. Of course, no one can be properly conversant with all these branches, but when the many subjects and problems are considered which confront a director of parks and reserves, including a botanic garden, the necessary qualifications for such a post are considerable enough.

We are now in a position to deal with the most important part of this report—namely, the means for giving a sound education to those intending to gain their livelihood by horticulture. As it is considered necessary to award degrees or diplomas for all professions, and even for many trades, so is a degree or diploma necessary in the case of horticulture. Such a degree or diploma should show (1) that the possessor has a sufficient knowledge of the sciences on which horticulture is based, and (2) that he has gained by experience a thorough practical knowledge of horticulture in a wide sense.

In order to become sufficiently acquainted with the various sciences already enumerated we consider that the student should receive instruction, theoretical and practical, preferably at one or other of the University colleges. But it must be remembered that in many cases the student will have to earn his living while studying for the degree or diploma, and that he frequently will be so situated that it will be impossible for him to make use of the superior advantages these colleges offer. In cases of this kind the teaching will have to be carried out at technical schools, or even high schools. As matters are at present the science syllabuses of the University colleges are not altogether suitable for horticultural requirements, and special or modified lectures, &c., would be necessary.

This leads us up to the matter of actual horticultural training, which falls under the two heads—(1) a course or courses of lectures based on the preliminary scientific knowledge which the student has gained, and (2) the practice of horticulture. This latter would have to be acquired by a number of years' experience in one or other of the following: a botanic garden or its equivalent; a municipal garden, with its many outside activities; a nursery garden devoted to raising a general stock of plants; a large private garden—but few such would be available. Then for special work there are orchards and market-gardens.

The next point to consider is the question of a degree or diploma. If a degree is decided on it would have to be conferred by the University of New Zealand. Doubtless such a degree is desirable, and some day it will come, should the demand arise, but it seems to us premature at the present time. Though an entirely satisfactory qualification is essential, if that can only be reached by means of a university degree

by far the greater part of those desirous of becoming accredited horticulturists would be excluded. Further, it would be necessary for all to attend the University colleges, and this, as already explained, would not be practicable, since the students would seldom possess the requisite funds, and the gardens where they were gaining their practical knowledge would frequently be far-distant from any of the colleges.

The Institute of Horticulture is a body composed of the leading horticulturists of the Dominion, together with some of the principal teachers of science in the University colleges, and scientific men of New Zealand. It is a body full of enthusiasm for horticultural education, and possesses the best knowledge of the subject which the Dominion can supply.

We consider that the New Zealand Institute of Horticulture—subject to what is recommended later—should grant a diploma in horticulture and should set up an examining Board. In this regard there is ample precedent in the cases of the Royal Horticultural and the Royal Agricultural Societies, which grant the National Diplomas of Horticulture and Agriculture respectively.

In order that the New Zealand Institute of Horticulture might function in this regard an Act of Parliament would be required. We therefore advise that a special committee* be set up by the Institute to consider the whole matter, and if the conclusion is reached that the best step in the interests of horticulture would be for the Institute to grant diplomas, then the same committee should fully investigate the financial aspects of the case. If it appeared certain that the financial obligations could be met—and this would in part depend upon the number of students sitting for the examinations—then steps should be taken for procuring an Act of Parliament. Evidently the matter is principally one of finance, and sufficient funds must be assured before taking the final step.

It is premature to draw up a provisional syllabus of the requirements for the diplomas, but a few suggestions seem required. These are as follows :—

(1.) The candidate should produce a certificate from the headmaster of the school he had attended that he had passed the highest standard with credit, and that he could write good English. We do not think that passing the Matriculation Examination is necessary, but a pass in English and agriculture (omitting dairy science) might quite well be demanded, together with the general paper in natural science.

(2.) The candidate should be employed in a botanic garden, &c., as already defined, for at least four years preceding his final examination. During those years he should keep a diary, not only detailing his daily horticultural experience but giving an account of what he had observed in the gardens, &c., of the neighbourhood, and in its natural and introduced vegetation, and telling also of the horticultural books and periodicals he had read and the horticultural shows he had attended. These diaries, we strongly recommend, should be presented yearly to the examining Board, and its report would decide if the year would count as one of the four, or if the time should be extended.

* Such a committee has since been set up, and has approved the principle of the granting of diplomas by the Institute. The committee is now further studying the matter.

(3.) The Intermediate Examination should consist of elementary chemistry, including soil-science, botany, and entomology, but all should have a more or less distinct horticultural bearing.

(4.) The Final or Professional Examination should consist of two parts, the one dealing with the principles of horticulture, which would include surveying and book-keeping, and the other with practical horticulture, which would include the identification of garden-plants and the use of a flora.

All examinations should be both written and oral, the latter to be considered the more important. Here we quote from the Regulations for the Royal Horticultural Society's examination for the N.D.H., since it exactly represents our opinion concerning examinations: "It should be remembered that the examination was designed to test first a candidate's practical knowledge, and secondly his acquaintance with theory so far as it assists garden practice. The examiners will do their best to discourage cram, to insist on practical experience. Books are only valuable when used intelligently to supplement the latter."

In addition to the young horticulturists there are the much older men of wide experience, some of whom, in part at any rate, have assisted in raising horticulture in the Dominion to its present state of efficiency, and whose work speaks for itself. We suggest that men of this calibre should receive without examination the diploma if the examining Board considers that their work has entitled them to this distinction. We would further suggest that only candidates over forty years of age come into this class. Such may make application for the diploma, stating their claims.

Candidates also who have had not less than fifteen years' practical experience might be excused the Intermediate Examination, and in the Final Examination be examined in practical horticulture only.

In all cases diplomas for these last two classes of candidates should be issued only for a limited period—say, three years after the coming into operation of the Institute's examining-powers.

For all examinations and diplomas fees should be charged, based on those to be paid for the examinations and degrees of the New Zealand University.

Graduates of any university holding any degree (including botany) equivalent to the B.Sc. degree of the New Zealand University might be admitted to the Final Examination after having had four years' practical experience as before defined.

With regard to horticultural teaching in the primary and secondary schools, provision is made for excellent horticultural teaching under the name of "Agriculture." If such teaching is carried out efficiently, and especially if the pupils are encouraged to use their powers of observation, an excellent foundation would be laid for building up the proper horticultural spirit in the people. All this lies with the teachers themselves and with the special instructors. Are these fully equipped, not only with the necessary knowledge but in realization of the importance of the subject as an essential training for all citizens? Above all, in the teaching in schools the indigenous plants of New Zealand should not be neglected. No branch of horticulture or hardly of general education is so eminently fitted to build up in the children's minds the love of their country.

SUBTERRANEAN CLOVER IN AUSTRALIA.

MR. J. W. DEEM, Instructor in Agriculture, who recently visited Australia, contributes the following notes on this subject :—

Subterranean clover is growing on extensive areas in South Australia, and is fairly well established in many parts of Victoria. None was observed by me in either New South Wales or Queensland. Various agricultural authorities spoken to in the latter States considered that it would not thrive, but this is difficult to understand seeing that white clover does exceptionally well in many localities, especially in the paspalum area on the north coast of New South Wales. However, I understand that considerable sowings are to be made this year, and the results will be interesting to watch. The Mount Barker district, in South Australia, has the credit of introducing subterranean clover into Australia, and certainly it is now the home of this plant in the Commonwealth. The district is thirty to forty miles from the sea, several hundred feet above sea-level, and has a rainfall of 30 in.

There is no doubt that subterranean clover has made a wonderful difference to the carrying-capacity of the land where it has been established, especially where top-dressing has been carried out. Its response to phosphates has been wonderful, and if top-dressing is at all systematic it quickly covers the whole surface. For a long time very little actual sowing of seed was done, farmers depending on the spread of the clover by means of stock, but now that seed is cheaper large areas are sown, seeding being at the rate of from 4 lb. to 8 lb. per acre, generally with a bushel of oats, on cultivated land; on pasture land the seed is broadcast at the rate of 1 lb. to 2 lb. per acre. Very little attempt appears to have been made to sow subterranean clover in conjunction with other clovers and grasses. However, a few farmers are now adopting this practice, and the results promise to be good. At the same time there is some danger that the subterranean clover will oust most other pasture constituents. Sowing is done in either spring or autumn, the latter for preference.

The harvesting of seed has been a difficult process in the past, but with the heavier crops obtained by the use of fertilizers the work has become much simpler. The general practice at present is to cut with a mowing-machine with a pea-tumbler attached. A yield of 300 lb. of seed per acre is considered a good crop, but up to 400 lb. has been obtained. I understand that Messrs. Howard Bros., the chief seed people of Mount Barker, have paid up to £8 per acre for the right to harvest clover-seed. Last year they saved 60 tons, and the price on the farm at the time of my visit was about 2s. 6d. per pound. For threshing, the ordinary clover-huller is used, after which the seed is put through a winnower with some proprietary attachments, the nature of which the owners do not care to disclose. I understand that at the last Melbourne Royal Show there was a cleaner shown which makes a perfect job of the work.

I was informed by farmers that in summer, when the pastures dry up, sheep will fatten on subterranean-clover seed left on the ground.

TESTING OF PUREBRED DAIRY COWS.

CERTIFICATE-OF-RECORD LIST FOR NOVEMBER AND DECEMBER.

W. M. SINGLETON, Director of the Dairy Division.

ALTHOUGH, apart from Holly Oak's Annie, no new class-leaders are included in the appended list, there is no dearth of good records, and many outstanding performances will be noted. Details of the performance of Holly Oak's Annie, owned and tested by Mr. W. T. Williams, of Pukehou, Hawke's Bay, and present Jersey champion for New Zealand, were given in a special note in last month's *Journal*, illustrated with a good photograph of this remarkable cow. In the present list her name and record will be found at the head of the mature Jersey class.

The outstanding record among the Friesians is that of the mature cow Oakwood Daisy Bell, owned and tested by Mr. R. J. Potter, of Pukerau, Southland, with 914·67 lb. butterfat. Her sire is Friesland Colantha Lad, sire of four C.O.R. daughters. Oakwood Daisy Bell was bred by Mr. Gladstone Robinson, of Gleniti, Timaru, and was purchased by Mr. Potter from the stud of Mr. W. D. Hunt, Waikiwi, at whose farm she gained a C.O.R. for 496·12 lb. fat, on a record commenced at the age of 2 years 341 days.

Among the Ayrshires, Mr. T. A. Montgomerie's Glencairn Miss Loudoun shows up very creditably with her record of 654·52 lb. butterfat, commenced at the age of 2 years 360 days. This record entitles her to second place in her class.

LIST OF RECORDS, NOVEMBER AND DECEMBER, 1925.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Glyndyfrdwy Clara*	J. R. Kelly, Morrinsville	2 25	243·0	361	10,326·3	631·76
Twylish Bell	F. J. Finer, Ngutuwera	1 345	240·5	365	13,205·9	582·29
Rebel's Leona	E. J. Sultzberger, Mangatoki	1 336	240·5	365	11,238·45	578·16
Uruti Princess	W. Oxenham, Uruti	1 354	240·5	365	9,788·5	543·32
Beechland's Maid of Honour	A. Moreland and Son, Te Rapa	2 14	241·9	345	10,026·6	542·06
Kareta	F. J. Finer, Ngutuwera	1 357	240·5	365	9,031·5	532·34
Rosy Creek Wavelet†	R. S. Tuck, Waharoa	2 0	240·5	365	9,827·75	520·85
Holly Oak Doucette	W. Oxenham, Uruti	2 25	243·0	365	9,240·9	519·59
Alfalfa Daydawn*	J. R. Kelly, Morrinsville	1 327	240·5	359	8,573·6	510·71
Golden Charm	L. and J. Griffith, Weraroa	1 347	240·5	365	9,580·2	510·68
Lady Generous	F. J. Finer, Ngutuwera	1 292	240·5	365	7,901·2	510·04
Waipiko Love	C. G. C. Dermer, Waipiko	2 6	241·1	365	10,092·3	505·80
Kuku Faith	R. L. Horn, sen., Ohau	2 31	243·6	365	10,899·5	497·28
Holly Oak Maizie	Kilgour Sisters, Kiwitea	1 282	240·5	365	8,314·2	489·34
Dainty's Fawn	D. Kennedy, Morven	2 22	242·7	365	7,663·8	487·13

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Middlewood Rene ..	Kilgour Sisters, Kiwitea ..	2 12	241·7	365	7,866·5	485·49
Colmore Owl's Isbel ..	A. E. Phillips, Maunu ..	2 39	244·4	365	7,972·9	483·38
Roslyn Genoa Princess	J. Harris, Bombay ..	2 89	249·4	358	8,530·2	478·18
Ranui Golden Treasure	J. H. Mungavin, Ohau ..	2 33	243·8	365	9,403·1	477·09
Jerseydale Faith ..	J. Pettigrew, Pihama ..	1 345	240·5	365	7,460·0	476·39
Middlewood Gladful ..	A. G. Somerville, Takapau ..	2 41	244·6	365	7,890·1	470·43
Koro Koro Sungleam	R. W. Southee, Kiwitea ..	2 28	243·3	365	7,850·4	459·72
Pecan	Boon Bros., Whakatane ..	1 329	240·5	365	8,426·0	458·22
Distinction's Maiden ..	W. H. Richardson, Lowgarth	2 51	245·6	365	8,862·3	454·35
Oaklands Princess Mary	H. C. Sampson, Hillsborough	1 361	240·5	350	6,819·1	453·52
Heatherlea Fox ..	H. J. Lancaster, Levin ..	2 48	245·3	365	8,923·7	452·35
Middlewood Daisy ..	Kilgour Sisters, Kiwitea ..	2 1	241·6	365	6,963·6	451·14
Brookley Lady ..	W. Johnson, Ngaere ..	1 362	240·5	346	6,537·7	448·30
Holly Oak Genesta ..	W. Oxenham, Uruti ..	2 18	242·3	365	7,552·6	441·41
Craigie Gift ..	P. C. Short, Lowgarth ..	2 64	246·9	365	9,283·0	438·23
Lingerie of Rosy Creek	R. S. Tuck, Waharoa ..	2 33	243·8	325	7,035·0	436·16
Orange Dale Ruby ..	W. J. Hall and Son, Matatoki	1 340	240·5	365	7,581·4	435·82
Woodstock Bargee ..	A. Banks and Son, Kiwitea ..	2 0	240·5	365	8,284·8	435·56
Oakland's Griselda ..	F. W. Cornwall, Bell Block	1 338	240·5	365	6,969·7	433·38
Rewa Sainfoin ..	W. H. Booth, Carterton ..	1 347	240·5	365	8,651·7	431·17
Jersey Dale Treasure	J. Pettigrew, Pihama ..	1 247	240·5	365	8,099·7	426·43
Jersey Farm Podgy ..	H. R. Benbow, Ormondville	2 57	246·2	365	7,353·7	425·40
Silver Sunbeam† ..	R. Weinberg, Niho Niho ..	1 359	240·5	365	6,315·6	420·21
Jersey Brae Constance†	T. Church, Te Rapa ..	2 48	245·3	339	6,861·2	419·22
Jersey Park Daphne ..	H. J. Addenbrooke, Ngaere	1 325	240·5	365	7,392·0	418·27
Noble's Dairymaid ..	S. Shalfoon, Opotiki ..	2 28	243·3	364	7,858·1	412·98
Woodstock Zany ..	A. Banks and Son, Kiwitea	1 316	240·5	365	8,723·2	408·75
Miro Meadow's Flo	A. A. Ward, Tariki ..	1 331	240·5	365	6,966·8	407·62
Jersey Farm Handsome	H. R. Benbow, Ormondville	1 322	240·5	365	6,233·1	396·63
Bronze Gleam ..	D. L. A. Astbury, Mangatoki	1 308	240·5	365	8,135·5	396·55
Springvale Golden Maid	H. C. Bishop, Brixton ..	2 18	242·3	364	7,725·3	396·46
Belvedere Nonetta ..	R. Wattam, Cambridge ..	2 53	245·8	365	6,465·6	395·50
Heatherlea Neatest ..	H. J. Lancaster, Levin ..	2 22	242·7	365	7,885·6	393·27
Ocean Fringe ..	L. Kavanagh, Waihi (Hawera)	2 38	244·3	335	7,571·3	386·59
Passadena's Lady ..	Kilgour Sisters, Kiwitea ..	2 25	243·0	357	7,862·5	385·89
Jersey Meadows Rose	H. H. Phillips, Te Rehunga	2 38	244·3	365	6,288·4	385·06
Rewa Aura	W. H. Booth, Carterton ..	2 14	241·9	365	7,496·5	382·78
Matai Nui Anthea ..	D. L. A. Astbury, Mangatoki	2 88	240·5	365	7,130·6	382·52
Sterling Cream† ..	R. Weinberg, Niho Niho ..	2 80	248·5	365	7,210·2	380·34
Murie's Finella ..	A. E. Phillips, Maunu ..	1 322	240·5	365	6,906·4	373·46
Asterias	L. Kavanagh, Waihi, Hawera	1 353	240·5	346	7,069·8	372·06
Fencourt Pearl ..	R. Wattam, Cambridge ..	1 315	240·5	365	6,562·5	371·70
Oakvale Lala ..	J. H. Street, Bell Block ..	2 50	245·5	334	6,483·2	368·26
Wotton Linnet's Linda	W. E. Pilcher, Raumati ..	2 35	244·0	365	7,213·9	366·61
Miro Meadow's Magnet	A. A. Ward, Tariki ..	1 259	240·5	342	6,822·7	365·78
Goodwood Ruby† ..	E. Griffiths, Cambridge ..	2 30	243·5	365	7,310·1	365·01
Woodstock San Toy ..	A. Banks and Son, Kiwitea	1 291	240·5	325	7,355·6	362·57
Kudos Nell	E. Harding, Woodville ..	1 362	240·5	365	6,269·2	355·76
Kuku Bonny Jean ..	R. L. Horn, sen., Ohau ..	2 0	240·5	326	6,289·2	350·77
Lynford Blue Bell ..	E. Grinlinton, Woodville ..	2 40	244·5	365	7,086·5	339·51
Jersey Holme Astral Lady	A. Buchanan, Palmerston N.	2 12	241·7	358	6,364·2	331·02
Jersey Meadows Lass	H. H. Phillips, Te Rehunga	1 271	240·5	356	5,783·6	325·13
Royden Anemone ..	H. Moreland, Newstead ..	1 345	240·5	346	6,135·5	317·04

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Woodstock Rosebud ..	A. Banks and Son, Kiwitea	1 278	240·5	309	5,607·2	304·20
Tillingdown Runa ..	H. O. Washbourn, Richmond	1 292	240·5	363	5,615·9	303·38
Remuera Emblem ..	E. H. Linnell, Midhirst ..	1 285	240·5	364	5,267·4	299·00
Oakland's Golden Maid	W. H. Waterhouse, Runciman	2 19	242·4	248	5,070·9	290·48
Willowbank Lady May	Boon Bros., Whakatane ..	2 114	251·9	256	5,058·5	284·73
Crofton Viola ..	A. J. Luxton, Omata ..	2 10	241·5	226	4,322·1	284·51
Remuera Jazz ..	E. H. Linnell, Midhirst ..	1 322	240·5	325	5,364·5	275·97
Cordelia	C. Stevens, Maungatapere ..	1 361	240·5	236	5,615·8	274·39
Trewithen Twylight ..	D. Kennedy, Morven ..	2 66	247·1	281	4,896·4	272·93
Dot's Charm ..	R. E. Clements, Awakino Point	1 347	240·5	365	4,883·4	270·40
Streamvale Topsy ..	T. Kenealy, Remuera ..	1 77	240·5	337	4,313·8	255·65
Tongahoe Butterfly ..	R. Hicks, Hawera ..	2 12	241·7	365	6,210·2	253·18
Kudos Patricia ..	E. Harding, Woodville ..	2 39	244·4	365	5,556·9	252·21
Remuera Choice ..	E. H. Linnell, Midhirst ..	2 51	245·6	302	4,480·4	247·29
Senior Two-year-old.						
Beechland's Preference	A. Moreland and Son, Te Rapa	2 322	272·7	365	12,010·2	655·49
Korokoro Empress ..	R. W. Southee, Kiwitea ..	2 316	272·1	365	9,167·6	588·52
Alfalfa Dairymaid ..	A. E. Phillips, Maunu ..	2 109	251·4	365	8,826·9	534·52
Silver's Fawn ..	W. S. Carter, Palmerston N.	2 286	269·1	365	9,148·5	520·77
Makara Queen ..	R. Haylock, Ngaere ..	2 345	275·0	365	8,388·0	506·50
Lincoln Lady ..	Dyer and McGuiness, Carterton	2 335	274·0	339	8,265·7	504·54
Holly Oak Delight ..	T. H. Verry, Pahiatua ..	2 186	259·1	365	8,683·4	450·56
Katykid	R. Haylock, Ngaere ..	2 329	273·4	365	7,663·3	439·35
Tinsel's Lady Clarabelle†	E. Hofmann, Katikati ..	2 351	275·6	365	8,838·9	435·97
Rosemont Lady Irene	E. L. Roose, Pukekohe ..	2 347	275·2	365	7,656·0	418·47
Matai Nui Diadem ..	D. L. A. Astbury, Mangatoki	2 307	271·2	365	7,008·0	408·90
Amuri Beauty ..	J. Blair, Waipuku ..	2 350	275·5	326	4,976·7	278·31
Holly Oak Kewpie ..	A. J. Hale, Hillsborough ..	2 217	262·2	209	4,362·7	272·09
Three-year-old.						
Onaero Gipsy Queen	J. O'Donnell, Bunnythorpe	3 327	309·7	353	12,947·2	666·51
Koro Koro Beryl ..	R. W. Southee, Kiwitea ..	3 355	312·5	365	11,867·8	658·38
Oakvale Violet ..	J. H. Street, Bell Block ..	3 271	304·1	365	10,045·3	647·04
Cowslip's Dimple ..	W. T. Williams, Pukehou ..	3 59	282·9	365	9,791·7	555·99
Woodland's Golden Gem	H. C. Sampson, Hillsborough	3 37	280·7	365	9,289·9	545·17
Richwood Maiden ..	A. E. Phillips, Maunu ..	3 35	280·5	365	11,034·8	542·49
Holly Oak's Sage Queen	F. Jennings, Mauriceville ..	3 205	297·5	365	8,757·4	541·68
Honeyfield Melia ..	J. Poletti, Bell Block ..	3 144	291·4	365	8,267·2	541·67
Onaero Ladybird ..	Boon Bros., Whakatane ..	3 25	279·5	316	9,358·5	506·30
Majesty's Swan's Lady	J. P. Bolland, Taupaki ..	3 208	297·8	365	10,311·1	491·97
Jersey Brae Lass† ..	T. Church, Te Rapa ..	3 339	310·9	334	8,251·3	491·61
Ohio Golden Tinsel ..	W. T. Williams, Pukehou ..	3 25	279·5	365	8,728·2	482·42
Willow Bank Evelyn	Boon Bros., Whakatane ..	3 21	279·1	332	10,236·0	470·95
Springbank Duchess Ella	F. S. Holdaway, Ballance ..	3 15	278·5	365	9,153·1	455·25
Creamlands Cissie ..	T. H. Verry, Pahiatua ..	3 291	306·1	339	11,694·2	437·26
Brookley Tessie ..	W. Johnson, Ngaere ..	3 46	281·6	328	7,677·4	382·52
Cloverlea Duchess ..	Truby King, Stratford ..	3 11	278·1	302	6,762·3	311·69
Royton Silk ..	H. Moreland, Newstead ..	3 122	289·2	313	5,312·9	305·86
Waipuna Petal ..	H. C. Wallace, Tamahere ..	3 37	280·7	300	5,185·9	288·60

LIST OF RECORDS—*continued.*

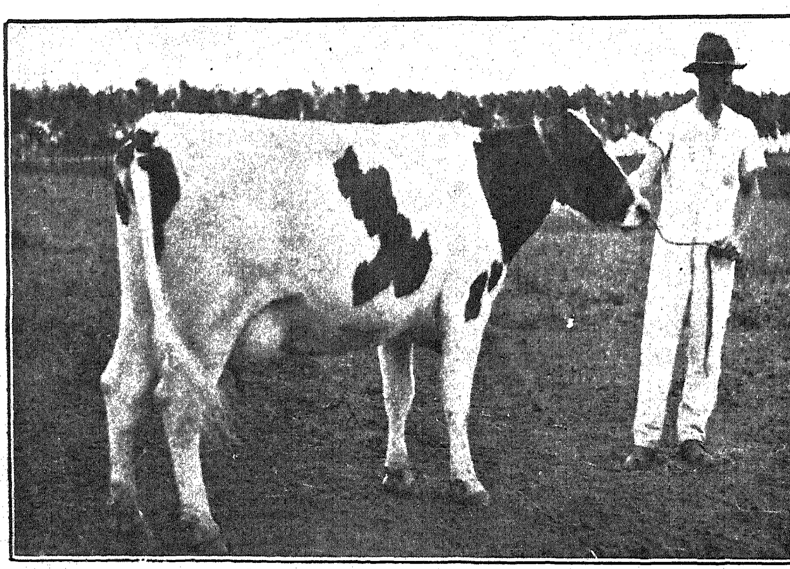
Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Four-year-old.		Yrs. dys.	lb.		lb.	lb.
Raithwaite Belle	F. J. Finer, Ngutuwera	4 23	315·8	365	13,731·7	704·09
Miro Meadow's Floria	R. W. Southee, Kiwitea	4 319	345·4	365	11,179·2	694·95
Maori Kit	H. B. Lepper, Lepperton	4 363	349·8	365	11,853·2	665·27
Koro Koro's K.C. Belle	R. W. Southee, Kiwitea	4 291	342·6	365	10,742·6	658·33
Crofton's Tiny	A. J. Luxton, Omata	4 292	342·7	365	11,147·5	613·64
Ivondale's Pretty	P. J. Petersen, Brixton	4 298	343·3	365	12,333·5	601·87
Woodstock Windflower	A. Banks and Son, Kiwitea	4 8	314·3	365	13,019·4	601·83
Trewithen Rose	J. Klenner, Kaimata	4 51	318·6	360	8,888·0	573·04
Meadowvale Doreen	E. O'Sullivan and Sons, Cardiff	4 315	345·0	365	11,053·9	572·91
Trewithen Floss	H. J. Lancaster, Glen Oroua	4 35	317·0	365	8,555·9	519·22
Rambler's Agatha	J. Mitchell, Hopelands	4 52	318·7	365	8,574·1	467·89
Gaytime	F. S. Veale, Cambridge	4 14	314·9	364	7,552·6	462·90
Jersey Meadow's Best	W. E. Pilcher, Raumati	4 53	318·8	313	5,477·8	337·76
Mature.						
Holly Oak's Annie*	W. T. Williams, Pukehou	5 9	350·0	365	18,522·7	1056·49
Woodstock's Fairy	A. Banks and Son, Kiwitea	5 354	350·0	365	14,940·1	835·70
Ivondale's Carnation†	P. J. Petersen, Brixton	9 1	350·0	334	13,683·7	738·85
Qui Vive	L. and J. Griffith, Weraroa	5 3	350·0	365	12,313·7	715·55
Countessa	A. J. Luxton, Omata	5 347	350·0	365	12,306·6	700·74
Oakden Gertie	S. J. Hollard, Rowan	5 343	350·0	365	11,011·0	630·91
Maori Venus	H. B. Lepper, Lepperton	6 16	350·0	365	10,193·7	627·69
Pilot's Jewel	H. C. Sampson, Hillsborough	5 325	350·0	365	11,774·6	613·46
Mabel's Chase†	E. Hofmann, Katikati	9 294	350·0	356	10,880·1	605·63
Meadowvale War Baby	E. O'Sullivan and Sons, Cardiff	5 337	350·0	365	9,535·4	601·03
Kahuwera's Enid's Hope	J. V. Mortensen, Pio Pio	5 302	350·0	365	9,217·8	599·06
Willow Bank Tester	W. Johnson, Ngaere	5 21	350·0	325	12,487·2	590·36
Fox's Freda†	E. Griffiths, Cambridge	8 344	350·0	347	10,967·3	587·05
Lizette's Masie	W. Oxenham, Uruti	8 23	350·0	365	12,108·7	585·27
Sweet Molina	A. J. Luxton, Omata	8 35	350·0	364	10,173·7	575·46
Gossiper	E. A. Alcock, Waihou	5 327	350·0	365	11,127·8	572·42
Feoni	A. and J. O'Donnell, Hawera	7 312	350·0	365	11,432·8	570·13
Floss of O.K.	J. V. Mortensen, Pio Pio	7 200	350·0	359	8,940·8	566·01
Kuku's Blossom	R. L. Horn, sen., Ohau	5 328	350·0	364	11,255·4	564·10
Maori Tit Bit	H. B. Lepper, Lepperton	5 88	350·0	352	9,007·1	560·72
Primula of Jersey Holme	E. L. Roose, Pukekohe	7 8	350·0	365	10,834·9	557·78
Jersey Brae's Countess	T. Church, Te Rapa	6 266	350·0	365	8,796·4	556·93
Jersey Lea Model Rose	S. Bowker, Ihakara	9 79	350·0	365	10,640·5	556·39
Fernaig Diana	C. G. Aickin, Woodville	6 168	350·0	365	10,427·1	556·13
Harmony Girl	A. J. Luxton, Omata	5 270	350·0	365	8,939·0	551·43
Beechland's Milana	A. Moreland and Son, Te Rapa	5 22	350·0	296	9,179·5	541·84
Lily's Perfection	E. J. Sultzberger, Mangatoki	5 3	350·0	348	10,284·8	538·20
Rewa Broom	Dyer and McGuiness, Carterton	7 21	350·0	308	10,664·8	533·62
Waipiko Joletta	C. G. C. Dermer, Waipiko	5 308	350·0	365	9,763·1	532·63
Gypsy Gold	J. H. Mungavin, Ohau	6 352	350·0	365	10,392·0	513·76
Oakdale's Lass	J. Poletti, Bell Block	7 330	350·0	299	7,814·6	504·46
Emerald Hill's Violet	E. J. Adams, Puni	6 167	350·0	340	9,628·7	503·61
Meadowvale Sundance	E. O'Sullivan and Sons, Cardiff	6 19	350·0	304	8,451·3	495·33
Orange Dale's Olga	W. J. Hall and Son, Matatoki	5 58	350·0	264	8,746·0	493·99
Coronet	D. L. A. Astbury, Mangatoki	6 236	350·0	347	9,021·8	493·89

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
			JERSEYS—*continued.*			
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Gowanbrae K.C. Topsy	Miss M. R. E. Saxton, Stoke	5 22	350·0	365	8,177·4	488·37
Waipuna's Ivy ..	H. C. Wallace, Tamahere ..	6 26	350·0	365	9,857·2	471·76
Bell Block Fancy ..	A. R. Gudopp, New Plymouth	6 62	350·0	355	8,771·1	471·49
Jersey Brae's Necklace†	J. T. Entwisle, Cambridge ..	7 8	350·0	300	8,012·8	466·29
Willow Bank Wonder Girl	H. J. Addenbrooke, Ngaere	5 6	350·0	365	8,528·25	461·70
Richwood Rose ..	C. G. Aickin, Woodhill ..	6 132	350·0	365	8,791·9	459·60
Waipuna's Peace ..	H. C. Wallace, Tamahere ..	5 53	350·0	323	7,678·2	450·14
Prim's Golden Lassie	W. J. Freeth, Waitara ..	6 224	350·0	328	7,744·8	449·45
Majesty's Orange Fox	F. S. Veale, Cambridge ..	6 30	350·0	328	9,775·5	446·56
Roslyn Cherry ..	J. Harris, Bombay ..	10 47	350·0	365	8,128·6	444·37
Belle's Beauty ..	W. S. Carter, Palmerston N.	5 270	350·0	365	7,921·3	441·30
Jersey Brae's Sea Shell	T. Church, Te Rapa ..	5 15	350·0	317	8,525·8	430·07
Orange Dale's Butter Lass	R. K. Garland, Okauia ..	5 359	350·0	327	7,527·7	426·62
Motu	J. A. Dearlove, Te Aroha ..	5 6	350·0	284	7,018·55	420·91
Mauriaena Veronica ..	C. G. Aickin, Woodhill ..	6 338	350·0	353	7,824·4	410·32
Meadowvale Sheila ..	E. O'Sullivan and Sons, Cardiff	5 342	350·0	283	6,465·5	409·96
Willow Bank Duchess	W. Johnson, Ngaere ..	5 52	350·0	316	7,145·8	402·22
Grafton Christmas Gift	S. J. Robinson, Hinuera ..	5 293	350·0	306	7,953·3	394·59
Lynwood's Lady ..	H. G. Lever, Tauranga ..	8 352	350·0	352	8,255·4	387·46
Springbank Lucky Lass	E. S. Holdaway, Ballance ..	5 55	350·0	285	8,095·3	383·04
Prim's Countess ..	C. G. Aickin, Woodhill ..	5 343	350·0	342	6,896·1	358·84
Fencourt Adora ..	H. Moreland, Newstead ..	6 268	350·0	365	8,479·9	358·56
			FRIESIANS.			
Junior Two-year-old.						
Dominion Woodcrest Domino	Central Development Farm, Weraroa	1 324	240·5	365	11,996·2	444·84
Dominion Domino Colantha	Central Development Farm, Weraroa	1 346	240·5	354	11,038·9	427·07
Dominion Piebe Johanna	Central Development Farm, Weraroa	1 350	240·5	365	10,492·1	414·31
Dominion Johanna Colantha	Central Development Farm, Weraroa	1 343	240·5	353	10,241·3	373·73
Dominion Jessie Kruger	Central Development Farm, Weraroa	1 334	240·5	365	9,688·4	357·36
Rouble Pieterje Valdessa*	John Court, Ltd., Auckland	1 274	240·5	328	9,003·1	346·36
Brookdale Lady of Fencourt	J. H. Jamieson, Cambridge	1 341	240·5	365	9,768·6	345·87
Dominion Woodcrest of Weraroa	Central Development Farm, Weraroa	1 294	240·5	311	10,983·0	332·13
Dominion Domino Fobes Beets	Central Development Farm, Weraroa	1 351	240·5	335	8,950·3	329·86
Senior Two-year-old.						
Ryvington Pontiac Stately†	A. M. Hodgson, Tamahere ..	2 275	268·0	365	14,770·3	536·99
Milkmaid Colantha Woodcrest*	R. Colee, Greendale ..	2 341	274·6	365	15,070·8	534·57
Dinah of Tikorangi† ..	R. S. Tuck, Waharoa ..	2 327	273·2	365	14,813·8	514·08
Cordyline Johanna Cremona†	A. M. Hodgson, Tamahere	2 346	275·1	365	11,447·4	414·63

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		FRIESIANS—*continued.*				
Junior Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Brookfield Betty Paxton†	Piri Land Co., Auckland ..	3 22	279·2	365	12,522·9	530·45
Fencourt Arcadia ..	J. H. Jamieson, Fencourt ..	3 41	281·1	353	11,865·3	407·06
Ellerlea Colantha Posch*	A. C. M. Finlayson, Kamo	3 65	283·5	200	10,510·0	374·26
Senior Three-year-old.						
Dominion Krugersdorp	Central Development Farm, Weraroa	3 313	308·3	365	13,578·5	470·07
Fairlea Friesia Mercena†	L. E. Allan, Putaruru ..	3 329	309·9	309	10,469·8	450·16
Junior Four-year-old.						
May Pontiac Mooie*	John Court, Ltd., Auckland	4 103	323·8	355	19,036·7	662·75
Livingstone Lady Klassje	W. J. Eames, Hunterville	4 14	314·9	341	12,134·6	412·59
Senior Four-year-old.						
Fairmont Johanna Fayne*	James Hart, Tatuanui ..	4 272	340·7	365	18,089·8	649·08
Mature.						
Oakwood Daisy Bell*	R. J. Potter, Pukerau ..	8 255	350·0	365	22,893·5	914·67
Bainfield 27* ..	C. H. Potter, Pukerau ..	6 351	350·0	327	22,775·9	775·00
Westmere Pietje Fobes*	R. A. Cameron, Paraparaumu	5 290	350·0	365	22,410·7	697·22



NETTIE OLLIE KORNDYKE DE KOL (JOHN COURT, LTD., AUCKLAND).

C.O.R., 1925, in Friesian junior two-year-old class: 17,874·9 lb. milk, 609·8 lb. butterfat.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	FRIESIANS—*continued.*					
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Inka Segis Pearl* ..	Matangi Friesian Farm Company, Matangi	7 64	350·0	320	16,571·1	621·99
Dominion Corona† ..	R. A. Cameron, Paraparaumu	6 362	350·0	365	18,615·8	608·31
Dominion Jessie Beets	Central Development Farm, Weraroa	6 324	350·0	362	18,234·7	603·96
Milkmaid Johanna* ..	C. W. Baldwin and Son, Ngatoro	7 57	350·0	272	16,506·8	571·65
Princess Johanna Korndyke 2nd*	R. Colee, Greendale ..	5 350	350·0	365	16,898·4	521·05
Colinton Kittanora Inka*	R. Colee, Greendale ..	6 17	350·0	347	14,633·4	502·38
Carlowrie Belle* ..	R. K. Macdonald, Edendale	6 68	350·0	320	13,833·9	446·89
Bainfield 31† ..	Waitemata Stud Farm, Hobsonville	6 362	350·0	350	12,645·4	429·44
	MILKING SHORTHORNS.					
Junior Two-year-old.						
Glenthorpe Lady 2nd†	A. J. Melville, Buckland ..	2 82	248·7	365	11,780·9	481·09
Pukekite Queen 2nd†	R. King, Buckland ..	2 35	244·0	319	7,978·2	353·10
Senior Three-year-old.						
Willow Banks Sunrise†	A. J. Melville, Buckland ..	3 361	313·1	295	10,545·7	494·52
Senior Four-year-old.						
Glenthorpe Countess 2nd†	A. J. Melville, Buckland ..	4 349	348·4	360	12,081·1	498·11
Mature.						
Riverdale Banker 2nd	T. W. Wardlaw, Waimana	..	350·0	339	16,016·4	610·91
	AYRSHIRES.					
Two-year-old.						
Glencairn Miss Loudoun†	A. Montgomerie, Kauwhata	2 360	276·5	365	16,835·3	654·52
Maesgwyn Lilac† ..	C. M. Williams, Ohoka ..	2 2	240·7	365	10,482·2	431·68
Three-year-old.						
Braeside Avril ..	Robertson and Blackley, New Plymouth	3 5	277·5	364	7,850·4	320·65
Four-year-old.						
Dimple of Edendale ..	W. Hall, Lepperton ..	4 346	348·1	365	15,232·4	628·58
	RED POLLS.					
Two-year-old.						
Dominion Louvain ..	Central Development Farm, Weraroa	2 294	269·9	365	7,136·7	410·62
Dominion Darling ..	Central Development Farm, Weraroa	1 325	240·5	350	6,665·9	329·59
Dominion Cuba ..	Central Development Farm, Weraroa	1 312	240·5	324	6,411·7	254·35

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		Second-class Certificates.				
		Jerseys.				
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Woodstock Flaunt ..	A. Banks and Son, Kiwitea	2 4	240·9	365	8,849·7	520·98
Penrose Superior ..	J. B. Clemow, Stratford ..	1 352	240·5	365	8,435·6	463·49
Senior Two-year-old.						
Betty Kilcoy ..	C. Stevens, Maungatapere ..	2 342	274·7	223	6,648·7	298·33
Three-year-old.						
Holly Oak Peeress ..	A. J. Miller, Uruti ..	3 320	309·0	365	10,611·3	623·24
Vibrona's Fancy ..	J. R. Colson, Waihou ..	3 8	277·8	365	7,830·6	487·82
Four-year-old.						
Charity's Sweet ..	J. H. Street, Bell Block ..	4 278	341·3	220	7,710·0	391·52
Mature.						
Darling Downs Pride	J. H. Street, Bell Block ..	5 342	350·0	365	9,384·7	527·06
Golden Gracey ..	A. Hazelton, Waihou ..	7 314	350·0	364	7,315·7	472·13
Gowanbrae K.C. Rose	M. R. E. Saxton, Stoke ..	5 4	350·0	365	7,862·9	457·25
		Friesians.				
Junior Two-year-old.						
Ada Pietertje of Fencourt	J. H. Jamieson, Fencourt ..	2 13	241·8	365	12,471·8	405·73
Senior Two-year-old.						
Ryvington Pontiac Holly	A. M. Hodgson, Tamahere..	2 349	275·4	351	10,793·1	410·41

THE BEET-SUGAR INDUSTRY IN VICTORIA.

THE Maffra district of Victoria, where the beet-sugar industry of that State is located, was visited recently by Mr. J. W. Deem, Instructor in Agriculture, who makes the following brief observations :—

This industry appears to be doing much better now, and the Maffra factory has shown a good profit during the past two seasons. Several of the local farmers grow upwards of 100 acres of sugar-beet. The seed is sown with a light coulter drill at the rate of 12 lb. to 14 lb. per acre, in drills 18 in. apart, the average drill sowing four rows at a time. Seed is imported by the factory and retailed at cost price, which for the past year or two has worked out at 1s. per pound. Most growers use fertilizers, chiefly superphosphate, at from 2 cwt. to 4 cwt. per acre. Two-thirds of this is drilled into the ground during the preparation, and the balance sown with the seed. There is at present a tendency to discontinue rolling before drilling, and to roll when the seed is through the ground. The beets are hand-thinned to about 12 in. in the drills. Intercultivation is carried out by a four-row cultivator of the Planet Jr. type. A yield of 20 tons is considered a good crop, and the beets were worth 40s. per ton at the factory last year. The roots are lifted by machinery and topped in the field. When these tops dry a little they make splendid sheep-feed, and up to twenty sheep per acre have been fattened on them. After the sugar has been extracted, the pulp is stored in a large silo and sold to farmers at from 1s. to 5s. per ton.

SEASONAL NOTES.

THE FARM.

CATCH-CROPPING FOR GREEN FEED.

OWING to the dry weather experienced this season in many districts most farmers will be anxious to produce green-feed crops as soon as possible. Provided the land is ready and there is sufficient moisture in the soil to cause germination, the sowing of cereals or mixtures of cereals and tares may be carried out during the coming month. If feed is urgently required, barley will give the earliest result; the Black Skinless variety is usually the quickest, and provides most feed in its early stages. No barley should be allowed to grow rank for green-feeding purposes. For late autumn and winter use, Algerian oats or a mixture of half oats and half barley will be found suitable generally. If the land is inclined to be sour a mixture of one-third each of oats, barley, and rye-corn has much to recommend it. Where the field is to be grazed right through the winter it often pays to sow 8 lb. or 10 lb. per acre of crimson clover with the cereal. This provides good grazing in the spring, and allows a good residue to be ploughed under. If the crop is to be carried through for hay or ensilage, mixtures of 2 bushels oats and 1 bushel tares or 2 bushels oats and 1 bushel Italian or Western Wolths rye-grass per acre, plus 3 lb. or 4 lb. red clover, are excellent mixtures. The addition of red clover to the latter mixture provides good stubble grazing or material to be turned under for green-manuring.

Under Canterbury conditions oat and oat-and-tare stubble can now be worked quickly and sown in Cape or Black Skinless barley at the rate of 2 bushels per acre, with 1 cwt. super. These barleys are very useful in Canterbury, and grow so quickly that they can often be fed off in from four to eight weeks after sowing. If late autumn or early winter feed is wanted, Gartons or any white oat may be used. Algerians are especially useful on the Plains and those places where turnips are difficult to grow. Should the turnip crop have failed from any cause, Algerian oats can be sown now and fed by the ewes about August. The stubble of oats and oats and vetches can be worked and put down in Italian or Western Wolths rye-grass so as to provide spring feed. February-sown Western Wolths is one of the most valuable crops for the Canterbury sheep-farmer, for, in addition to feeding, a summer crop of seed can often be obtained. It sometimes happens that a crop of oats has shaken badly at harvest, and if this land is skimmed and left a good shower of rain will result in some very useful autumn and winter feed.

CEREAL HARVEST NOTES.

February is the usual harvest month for white crops in Southland and South Otago. The oat crop in many parts of these districts will be ready for cutting by the beginning of the month. Cutting should

commence when there is a considerable amount of green tinge on the glumes, with the grain fully developed, as oats ripen considerably when standing in the stook, and any loss which may occur from cutting on the green side is practically negligible when compared with that from shedding owing to overripeness.

Unless harvested wheat is in very good condition, and the weather settled, it pays to stack it, and leave it in stack from six to eight weeks, so as to allow the grain to harden up after the sweat. If the crop has been stook-threshed too much care cannot be exercised in covering the stack of grain-sacks on top and at sides with straw and tarpaulin until removed to more permanent storage.

SOWING OF PERMANENT PASTURE.

There is considerable diversity of opinion on the relative merits of autumn and spring sowing of permanent pasture, and much can be said on both sides. Sometimes a poor autumn take is a result of late sowing, or the particular land may lie too wet and cold during winter. In such cases the young plants develop poorly, and the spaces between become filled with weeds. Here spring sowing would be preferable. On the other hand, a spring sowing has more competition from weed-growth. The whole matter must be decided by the circumstances of each case, but whichever the season chosen the preparation should be thorough. A well-consolidated seed-bed, with sufficient shallow surface tilth to cover the seed, is the main object. A number of instances have come under notice recently where almost total failure has resulted from a deep, loose seed-bed, the only parts showing a satisfactory take being on the consolidated wheel-marks of the machine or the hoof-marks of the team.

Where it has been decided to sow autumn grass the land should be broken up as soon as possible. Grass follows better after some fed-off crop, such as rape, millet, kale, or peas. If possible it should not be sown after a cereal crop, owing to the danger of grass-grub and the depleted fertility of the soil. While it is not good practice to sow stubble land to pasture, on many farms this cannot be avoided. Where such is necessary the land should be ploughed early and allowed to lie up to the weather, so as to destroy weeds, allow the stubble to rot, and give the soil the benefit of the sun. Grass sown after a cereal crop should get a liberal dressing of fertilizer—not less than 2 cwt. per acre.

LUCERNE.

Young crops of lucerne sown about the end of November and in December should be ready for their first cut in February. It is very important that this cutting should not be made too soon. Unless the lucerne is being smothered with weeds, or there is a heavy growth of weeds threatening to ripen seeds, the first cut should be delayed until the new growth is coming away from the crowns. About this time a fair number of the plants will be showing in bloom and the leaves will be dropping. Too early cutting of young lucerne retards root-growth. If weather conditions are suitable the stand should be given a light cultivation with the tine harrows or light cultivator after the crop has been removed.

February is a good month for destroying grass and weeds on old lucerne stands. Where necessary this work should be carried out by

means of a cultivator fitted with suitable teeth. If other implements are available, disks should not be used for summer cultivation.

Top-dressing of lucerne should be done in the autumn rather than in the spring, as in the former season the manure is less likely to encourage weeds. If the soil on which the lucerne is growing is either naturally rich in lime, or if lime has been applied to the stand, it is safe to conclude that superphosphate, at the rate of 2 cwt. per acre, will be a suitable top-dressing.

In Central Otago many irrigators will be sowing lucerne, and emphasis is laid on the fact that the seed-bed must be thoroughly prepared. The seed should be sown broadcast or in drills at the rate of 15 lb. per acre, and this can be done either through the hurdy-gurdy or by mixing the seed with finely ground rock phosphate and sowing it through a grain-drill or an ordinary seed-drill. Previous to sowing, the ground must be deeply ploughed, disked and cross-disked, harrowed, and then rolled with a Cambridge roller. A common mistake is sowing too deeply. A light brush harrow, or one made from strips of wire-netting laced together and weighted at the end with bolts, is probably the most satisfactory for covering the seed. On no account should the ordinary tine harrows be used, as they bury the seed too deep. It is important to remember that sowing should follow irrigation, and not *vice versa*, otherwise the ground will be left in a cold, damp condition, unsuitable for seed-germination.

FEEDING-POINTS.

Where forage crops are available, supplementary feeding of dairy cows should be commenced before the grass pastures lose their succulence. It is advisable to mix these forages as much as possible, so as to balance the ration. Maize and lucerne or maize and peas go well together; or, if maize, lucerne, and soft turnips are available, it is good practice to feed the maize or lucerne, or both, in the evening, and the soft turnips in the morning. Soft turnips carted out one day and fed the following morning are much better from the point of view of the quality of the milk than if fed straight from the field. If other feed is available, 60 lb. of soft turnips per cow per day should be the maximum allowance.

On mixed farms kale crops which have been fed once may be shut up, and the crust broken by cultivation between the rows By this means a second growth is generally obtained, which can be used to flush the ewes before tupping. At the end of April the crop can be cultivated again and shut up for the winter. The feed is useful in spring both for hoggets getting their teeth and for ewes in lamb.

A good many farmers now grow peas for lamb-fattening, and inquiries have been received as to the best time to stock the crop. This is just when the main portion of the peas are firm and turning colour in the pods. If stocked earlier the lambs do not take to them readily, and there is considerable waste. If dry weather prevails practically every pea will be picked off the ground. Lambs should not be confined to peas for a start, as they require a few days to get accustomed to them, and during this period they should have access to other feed. After about a week the peas are eaten readily, and the necessity for other fodder is not so

great. However, lambs fattening on peas will always do better if they have a run-off, even if it is in a bare grass-paddock. If possible, they should also be provided with good, clean drinking-water.

SUMMER TILLAGE.

The value of early skimming or sunshine cultivating is inestimable, whether the land be ploughed out of lea or stubble, and whether the cultivation be for autumn grassing, autumn-sown cereals, catch-crops, or winter fallow. Not only does such tillage ensure a good bottom for the seed-bed, but it conserves moisture, and more especially kills weeds. In Canterbury the hot sun and north-west winds of February are of greatest assistance in eradicating twitch. Frequent skimming or cultivation before the final deep ploughing is the best method of dealing with twitch. Hence it will pay to keep the team or tractor going as hard as other operations will allow.

MISCELLANEOUS.

The intercultivation of root crops should be kept going as long as possible. In this way weeds are kept in check, the soil is aerated, and moisture conserved.

Preparation should be made for saving seed from the main potato crops. Only those tubers free from disease should be selected, and, although the storage of immature seed is not always easy, such seed usually gives the best results. Medium seed about the size of a hen's egg is generally the most suitable.

In Marlborough red-clover stands which were cut for hay in November or December have come away again, and owing to the very dry weather experienced have run to head, the growth still being stunted. The best practice with such stands is to feed them down or mow them, so that when rain comes there is a chance of further growth. Although it will now be too late for a seed crop, the growth of autumn feed will be highly valuable both for sheep and cattle.

Any surplus crops of green cereals, maize, clover, lucerne, or grass growth may still be converted into ensilage, where not less than 25 to 30 tons of material is available. Well-made ensilage, it may again be repeated, is a valuable stand by for the dairy-farmer, and more use should be made of this means of utilizing surplus fodder to tide over periods of shortage.

Clearing of noxious weeds should be continued where necessary. Californian-thistle cutting should be carried out before the seeds are broadcasted by the winds. Second growth of ragwort will also require attention as regards the flower-heads.

—*Fields Division.*

THE ORCHARD.

SPRAY-STAINS.

In a general way there is very little to add to last month's remarks with regard to spraying for the various pests and diseases, but growers are advised to exercise the greatest care in the application of future sprays, with a view to reducing spray-stains to a minimum.

It is not suggested that growers should cease using arsenate of lead for the control of codlin-moth and leaf-roller. These pests must be prevented, and we cannot risk numerous codlin grubs and leaf-roller caterpillars hatching after the fruit is packed, which would seriously interfere with the quality of our pack. Spray-stains can be avoided to a great extent by using the arsenate of lead alone with a spreader at the latest application prior to picking. The addition of lime in excessive quantities gives the fruit a white appearance, and lime-sulphur and Black Leaf 40 in combination with arsenate of lead often gives the fruit a dirty appearance.

While on the subject of spray-stains it is opportune to draw attention to the unsightly appearance of apples when the apple leaf-hopper is allowed to become prevalent. The dry weather that has been experienced is very favourable to this pest; Black Leaf 40, at 1–800, should be applied at short intervals if the insects are in evidence.

FRUIT EXPORT.

Early February will see the commencement of the export season with Gravenstein, Willie Sharp, and Worcester apples. Every care must be taken to see that immature fruit is not shipped, but the two first-named varieties must be picked as soon as the leaf-green colour has faded and the straw colour begins to develop. In these early varieties the interval between export maturity and local-market maturity is very short. As regards Worcester, last season's experience seems to point to the necessity of a little more maturity to prevent shrivelling. Cox's Orange will follow, and a good striped appearance with a changing colour is the best guide as to picking. In Dunn's a perceptible change in the ground-colour, and if possible a slight tinge of colour on the cheek, is a good indication of readiness for export. The reports from London last season were very favourable as regards the maturity on arrival, and this should be a good guide for the coming season.

In the matter of packing, the best advice is to pack a full case; an overfull case means bruising before the case leaves the shed, while a loose one means bruised fruit by the time it reaches its destination. Excessive bulge should be avoided; give just enough to ensure sufficient tightness to prevent rattling. Keep the size uniform; $\frac{1}{4}$ in. allowed under the regulations is quite sufficient to ensure good packing, and a greater variation is not acceptable to buyers. Grade carefully according to the standards defined; unsightly blemishes, although they may not exceed 5 per cent., are not desirable. Appearance goes a long way in selling any article, and this should be kept in mind when packing for export.

MISCELLANEOUS WORK.

Budding can still be proceeded with; just after rain is a good time, when fresh impetus is given to the sap-flow.

Remember that insect and fungus pests are carried over for the next season by rotting fruit; therefore clean up and destroy all grubby apples and pears and fruit affected with brown-rot, &c.

If cultivation is done for the season, put the tools away under cover and grease all shifting parts.

There is still time to put in a green crop if the land is in order. A better growth will be secured by the addition of manure ; phosphates and lime applied now will not be lost, and, if available, do not hesitate to put them into the land.

A little more time at thinning overloaded and weakly trees will ensure a more marketable product and give the tree a better chance.

Clean rubbishy growth from under the trees, even if deep hoeing is not convenient. Such growth affords cover for grubs, beetles, earwigs, leaf-hoppers, &c.

—*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

Continued cultivation is the main work for the coming month in the grove. With the prolonged dry weather experienced trees will be considerably retarded and suffer a varying amount of foliage-loss according to moisture available. Keeping the surface soil well stirred is the first essential, but the destruction of all weeds is very necessary, as much moisture escapes from the soil in growths of this sort.

It is good practice to apply a mulch at the present time. If stable manure is available a good dressing should be spread over the soil under the trees, taking care not to pile the material up round the trunk of the tree, as bark-injury is caused by contact with fresh manure. Straw, hay, or any available litter will also serve the purpose, though these materials would not be of such value when turned under later.

As a general rule irrigation is not necessary in the citrus-groves of this country, but there are occasions when it could be resorted to with advantage. There are generally to be found odd trees so situated as to suffer very materially during dry weather, but a good soaking with water when the trees are drooping will often save defoliation and loss of crop. Such applications of water are better given in furrows, which should be levelled down after the water has soaked in. Where water is readily available the better results will well repay for the time spent in irrigation.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

POULTRY TROUBLES AND MANAGEMENT.

ALMOST daily I receive letters asking for advice regarding the treatment of stock, arising generally out of improper management. Seldom, however, do the writers supply the detailed information necessary for understanding the cause, much less for suggesting a remedy. To advise any one on troubles met with in the various branches of poultry-keeping is not always satisfactory even when the inquirer has fully and accurately described his case. When, however, the position is only partly set out it is practically impossible to give any advice at all. For example, the other day a correspondent asked for the cause of his hens dying, but no mention was made as to their age, nor details regarding symptoms, the food supplied, or the general conditions under which they were being kept, a knowledge

of which is necessary to arrive at a probable explanation of the difficulty.

The advice has been given in the *Journal* notes over and over again that constitutional vigour should be the first consideration in the maintenance of a healthy flock. If a strong constitution is not possessed the birds cannot be expected to lay to their maximum capacity and, what is equally important, ward off those infectious diseases which are a menace to the industry. The only safe way to fight disease is to prevent it. True, infectious disease sometimes makes its appearance in the best-managed flocks, but there is invariably a cause, either through birds being introduced from outside or to some obscure little defect in management. At times it is impossible for the keenest of poultrymen to locate the origin of troubles met with.

This emphasizes the necessity for taking every means of preventing disease becoming established. Where a fowl shows the slightest symptom of disease, perhaps through the medium of a weakly specimen from stock having a predisposition to a particular trouble, the affected bird should be promptly isolated. The next important step is to find the cause, and remove it. If the trouble is allowed to gain a good foothold it may be next to hopeless to attempt to check it ; or, if it is stopped, very serious losses will have taken place.

Recently a case came under my notice where one bird was introduced to a plant suffering from a complication of diseases—chicken-pox and diphtheric roup. The necessary measures for preventing the trouble from spreading were not taken, with a result that the disease rapidly spread through the flock, and in less than six weeks over thirty (including many of the most valuable specimens) of the total flock of two hundred succumbed to the disease. This is only one case in point ; many a similar one could be related. Indeed, I have in my mind several large plants where an outbreak of disease may be anticipated at any moment.

Intensive poultry-farming is a successful enterprise in this country, but the more intensive the system the greater the need for sound management and the maintenance of the most exacting conditions. Having the houses draught-proof and in a thorough sanitary condition will help matters, but this is not enough if the yards are allowed to become stale and a breeding-ground for parasitic life and disease. A thoroughly clean run, especially where young stock are concerned, is just as important as a thoroughly clean house ; indeed, everything should be clean about poultry. It should never be forgotten that a bad system of management will rapidly discover a weakly-constitutioned bird and encourage the passing on of the trouble to other members of the flock.

In all but a few isolated cases the disastrous troubles of common and diphtheric roup, so prevalent during the early spring, could be seen at once to be due to weak management, disease being practically invited through bad quarters or foul runs, or by insufficient or inferior diet.

Recently where advice was sought in a serious case of infectious disease the conditions were found to be so bad that the wonder was that disease had not wiped out the flock long before. The trouble was chiefly due to the owner attempting to build up a large flock

before he had provided proper accommodation, and before he knew how to handle fowls on an economical scale, these weaknesses being accentuated by the mistaken belief that it is possible to overfeed the high-type layer.

I cannot emphasize too strongly the necessity of having the houses absolutely draught-proof, the use of alternate runs so that the birds may occasionally have a change to fresh ground, and continual warfare against vermin. Cleanliness in all things is essential; it is invariably the hall-mark of the successful poultryman. Dirty, draughty houses, low feeding, and breeding from weak stock are an invitation to disease.

CONDIMENTS.

It is surprising the number of poultry-keepers who have recently resorted to the use of condiments and stimulants as a means of promoting egg-yield and reducing the cost of the food bill. This has led to serious difficulties from ovarian troubles—protrusion of the oviduct, the production of shell-less eggs, &c., and in addition a generally reduced egg-yield. As might only be expected, such experiments have proved costly to those who have undertaken them.

It should be remembered that the power to produce eggs is an hereditary character, and to enable a bird to yield to her maximum capacity it is only necessary to maintain her in a healthy condition and to supply her with the food required for the manufacture of her product. It is true that the condiment will stimulate the egg-producing organs, but the effect is brief, and the reaction which sets in not only defeats the end but undermines the constitution, making the bird unsuitable as a breeder and a susceptible individual to every passing ailment.

If any argument is required as to the futility of condiments for consistently stimulating egg-production it is surely supplied by the high records put up at the egg-laying competitions which are established without the aid of such stimulants. The condiment is the refuge of the amateur and the bugbear of the practical man.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

TESTING HONEY FOR RIPENESS.

BEFORE tinning off the honey the beekeeper should make certain it is ripe. Fermentation is sometimes quite a serious problem to the producer, and yearly large quantities of honey which were thought to be well ripened at extracting-time ferment, more especially when left over till the weather becomes warm. The greater part of the honey produced in New Zealand is exported, and a matter of first importance is its condition on arrival at the overseas market. Usually beekeepers experience little difficulty with low-specific-gravity honeys if care is exercised and only well-sealed combs are extracted from. However, to ensure that the honey is up to standard it should be tested with a hydrometer before being run into the tins.

When making the test the contents of the tank should be gently paddled, in order that the honey may be of the same consistency throughout. This operation is of importance, as there is always a risk of variation of the specific gravity of the honey at the bottom and top of the tank. If on testing with a Twaddel's No. 4 hydrometer the instrument does not sink below 84 a well-ripened honey is indicated. This is equal to a specific gravity of 1·42, the test being made at a temperature of 60° F. As the temperature of honey in the summer rarely sinks so low, the test may be taken at 70° or 80° by adding one point to the hydrometer-reading for each ten degrees of heat over 60°. Thus, if the hydrometer sinks to 82 at a temperature of 80°, it would register 83 if taken at 70°, and 84 if taken at 60°. To arrive at the specific gravity multiply the hydrometer-reading by 0·005. Thus $84 \times 0{\cdot}005 = 0{\cdot}420$; add 1 for the specific gravity of water, and it will equal 1·420. This method is only reliable up to a temperature of 90°.

TESTING THICK HONEY.

Sometimes the honey is so dense that the hydrometer will not sink. When such is the case, take equal parts by volume (not weight) of honey and water, mix thoroughly, test with a No. 2 Twaddel's hydrometer, and then multiply the result by 2. This will give the same result as if taken with a No. 4 instrument by the direct method. Thus, if the No. 2 instrument sinks into the honey and water to 42, this multiplied by $2 = 84$. Perhaps the quickest and simplest method for testing thick honey is to have a deep glass or beaker on which is a mark, to contain about 4 oz. of water. Fill up to the mark with water, then pour it into another vessel; now fill up to the mark with liquid honey, add the water previously measured, and mix thoroughly; then place in it the No. 2 hydrometer, note the number to which it sinks, and multiply by 10; place the decimal point before the result, and add 1. Thus, if it registers 43, $43 \times 10 = 430$; place the decimal point before the $430 = 0{\cdot}430$; to this add 1, which is the specific gravity of water, and the result will be 1·430.

SUPERSEDING QUEENS.

During the progress of the honey-flow it is wise not to overlook the work proceeding in the brood-chamber. All old and failing queens should be superseded, and queenless hives supplied with young queens. To a large extent weather conditions play an important part in the mating of the queens, and if by any chance they are not able to take a wedding flight they will develop into drone layers. As fertilization of the queen takes place in the air, good weather must prevail or the drones will not fly. Hence the necessity of overhauling the hives to note their condition.

It is highly important that all colonies should go into winter quarters headed by a vigorous mother. Too many colonies are lost by queens failing in the spring months. The activities of the queen should be such as to meet abnormal wastage, and brood-rearing should proceed, or spring dwindling will assuredly follow. A good queen will keep her brood-nest compact, and fill the combs

solid with brood from end bar to end bar, whereas failing queens scatter the brood, laying a patch of eggs here and there. When such queens are detected immediate attention should be paid to superseding them. If, as advised previously, nucleus colonies were formed for the purpose of carrying out queen-rearing during the season, the surplus queens can be utilized for doing the work. If no queens are on hand an order should be sent immediately to a recognized queen-breeder for an Italian queen, so that when introduced she may proceed with egg-laying before the winter weather approaches.

APIARY REGISTER.

There is no gainsaying the advantages to be derived from making a complete record of the individual hives in the apiary. Records thus kept enable the beekeeper to work to a system, and tend to improve apiary management. It is well-nigh impossible to conduct an apiary on commercial lines unless the beekeeper takes notes at each examination. Working in the dark with respect to the age of queens, surplus, &c., is poor policy. In the absence of books the hive-cover may be used for writing notes on. A book may be mislaid, but records made inside the cover are more in the nature of a permanent handy reference. If advisable, in the beekeeper's spare time these rough notes may be copied into a complete record-book.

TREATMENT FOR FOUL-BROOD.

No effort should be spared to treat all colonies known to be affected with foul-brood. If the work is delayed the colonies will not build up to sufficient strength to winter safely. Under no circumstances should the work be put off. Treat all infected stocks while the flow is on, and endeavour to winter none but clean colonies. There is a great risk of spreading the disease to clean colonies in the off season, as robbing is more apt to break out. "Keep your bees clean" should be the maxim of every beekeeper. Where any doubt exists as to the complete absence of disease in the apiary an excellent plan is to mark all combs with the number of the hives to which they belong, so that when extracted they may be returned to the colony from which they were taken. If this plan is followed, even if any of the hives are diseased, the risk of spreading infection by means of wet combs is considerably reduced.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

THE winter crops will now be established in most sections, and demanding occasional cultivation to destroy weeds and promote growth. The plants may be given a little judicious encouragement in the way of small doses of nitrate of soda in showery weather. Should the season be dry the larva of the diamond-backed moth, green aphis, and thrip insects are sometimes a plague. A spray composed of arsenate of lead

and tobacco concentrate is a very effective remedy in small crops. It could be applied with a knapsack pump, but for field crops the potato-sprayer would be required.

Commercial celery crops should be planted only on drained land that is naturally moist, but it sometimes happens that a particularly dry spell is experienced at this period, in which case arrangements must be made for irrigation of the crop. The operation known as earthing-up may be performed when the plant has almost completed its growth.

A dry spell at this season is also very injurious to crops of cucumbers, marrows, melons, and pumpkins. Regarding the first two kinds of these gourds, the fruits should be gathered promptly as soon as they are of size. Not only is the flavour better, but the crop will be greatly increased.

The next crop of asparagus and rhubarb will depend for its size and quality on the growth and vigour of the plants during the autumn. To encourage this, see they do not lack water and occasional dressings of fertilizers now.

Those who have good isolated beds of asparagus might well consider the growing of high-quality seed. To do this, all cull plants, more especially those of the male type, should be heavily rogued before flowering, the seed crop following being gathered from the best female plants only. Seed of this class is in urgent demand by commercial planters.

Sowings may be made now of French beans, lettuce, spinach, and swede turnips, and towards the end of the month cabbage and cauliflower for early spring cutting.

THE TOMATO CROPS.

The outdoor tomato crop will now be in the middle of the harvest period, and housekeepers should be informed of the fact. Sauces, purees, and preserves of this popular fruit are much appreciated, and a reminder in the way of suitable advertising would avoid the annoyance of the missed opportunity, which is so common among people living in the towns.

Under glass the tomato crop is about finished, and nothing is gained by leaving the house in disorder. The old plants should be removed and burnt, and the house cleaned up. Where white-fly has been troublesome it will be necessary even to fumigate the house with cyanide gas, and in some cases repeat the operation for the destruction of insects hatched out subsequent to the first fumigation. The methods and means adopted will depend on the experience of the past season. Finish off by sowing the house down in a green cover-crop, or a crop of some kind.

SMALL-FRUITS.

In the berry-fruit sections harvesting Cape gooseberries, cleaning up raspberry and strawberry breaks, and spraying gooseberry and currant plots as required will be the chief work at the present time. Where renewals have to be made it is well to consider and plan the work now, well ahead of the time for action. In fact, where new plantations of strawberries are contemplated the preparation of the

land may be commenced, so important is it that the ground should be thoroughly cleaned before planting.

TOBACCO-GROWING.

Some of the earlier-planted tobacco crops will now be about ready for harvesting. For the pipe tobaccos grown here the usual method is to split the stalk to near the ground and cut it off at the surface; after being left on the ground for half an hour or so to wilt, ten or twelve of the stalks are threaded on a 4 ft. curing-stick and hung in the curing-shed to dry. The signs of ripeness are a paling of the green-leaf colour and a yellow mottling appearing first on the lower leaves. The plants are usually harvested when the middle leaves on the stalk show these signs. The plants must be dry, and are in best condition for harvesting in fine warm weather. When the loaded curing-sticks are hung on the tier poles in the curing-shed the method is to keep the shed closed for a while until the green colouring of the leaf turns to yellow, and as soon as this stage is reached to dry them quickly and maintain a good even bright colour. In handling, every care should be taken to avoid tearing the leaf. Leaves beaten and bruised in the wind will never make a first-class sample, and the price obtained will suffer accordingly.

—*W. C. Hyde, Horticulturist.*

EXPORT OF FRUIT, 1926 SEASON.

I. CONDITIONS OF GOVERNMENT GUARANTEE.

CONDITIONS for the Government guarantee on shipments of apples and pears made from New Zealand during the 1926 export season are as follows:—

1. The guarantee shall be limited to approved varieties and classes of fruit packed in compliance with the requirements of the "Extra Fancy," "Fancy," and "Good" grades, and shall be restricted to a maximum of 350,000 cases of apples and 8,500 cases of pears.

2. The Government's liability under the guarantee shall include all packing and marketing expenses which the Department of Agriculture may deem reasonable and necessary, plus 3s. 4d. per case with respect to "Extra Fancy" and "Fancy" grade apples, and 1s. 6d. per case with respect to "Good" grade; and 1d. per pound with respect to pears. No allowance to be made for cool storage unless an approved system of precooling is adopted, in which event such allowance shall not exceed 5d. per case; and, further, the insurance allowance shall not exceed that required to provide an ordinary marine-risk cover. In case of shipments to the United Kingdom no charge for selling-commission exceeding 5 per cent. will be allowed, nor will a total exceeding 1s. per case be allowed for the following overseas charges—namely, supervision, port rates, dock charges, warehousing, cartage, tolls, porterage, forwarding, and surcharges.

3. The guarantee to be limited to fruit grown and shipped (otherwise than under a f.o.b. contract) by *bona fide* fruitgrowers or fruitgrowers' co-operative societies, through the New Zealand Fruit-export Control Board or other channels approved by the Minister of Agriculture.

4. Any grower who exports any portion of his "Extra Fancy" or "Fancy" grade fruit crop outside the guarantee shall be deemed to have forfeited his right to participate in the guarantee with respect to all fruit exported during the season by him or on his behalf.

5. All fruit to qualify for the guarantee must be passed by an Inspector of the Department, and must be packed in accordance with the Export Regulations, subject to the modifications and directions set out in the appended statement entitled "Export Regulations."

6. Payment of claims under the guarantee shall be calculated on the basis of the average price received by the claimant for the whole of the "Extra Fancy," "Fancy," and "Good" grade fruit exported (otherwise than under a f.o.b. contract) on his account during the season, irrespective of markets.

7. Where, however, fruit of more than one variety and supplied by more than one grower is exported by a joint packing company or group in its own name the guarantee shall be calculated separately in respect of the whole of the fruit supplied for export by each grower, on the basis of the pool price received for each variety supplied by him with respect to each shipment; provided that the joint packing company or group shall have, not later than seven days after the fruit has been shipped from New Zealand, notified to the Director of the Horticulture Division full particulars of each grower's fruit included in each shipment.

8. The Government reserves to itself the right (*a*) to withhold the guarantee with respect to any variety of "Good" grade apples in the event of the Director of the Horticulture Division being satisfied that the grower of such apples is not shipping a reasonable proportion of "Extra Fancy" or "Fancy" grade fruits of that variety; (*b*) to limit the quantity of fruit shipped to any particular port should freight rates or market conditions, &c., be deemed unsatisfactory; (*c*) to insist on all fruit being precooled prior to shipment, if deemed necessary; (*d*) to withhold the privileges of the guarantee from all fruit shipped in vessels the storage facilities of which are held by the Department to be unsatisfactory; (*e*) to withhold the privileges of the guarantee with respect to any market in connection with which the New Zealand Fruit-export Control Board are of the opinion a satisfactory f.o.b. or c.i.f. trade is or can be established.

9. The Government reserves the right to re-examine and to withdraw any fruit from export in the event of such re-examination indicating that by reason of overmaturity or other cause inimical to the keeping-qualities of the fruit it would be inadvisable to allow such fruit to be exported. All fruit so withdrawn may be disposed of in New Zealand by the owner without reference to the guarantee, or by the Government on behalf of the owner. In the latter event the proceeds will be credited to the owner, and the transaction dealt with generally as though the fruit had been actually exported under the guarantee. But should such re-examination reveal the fact that any line of fruit, through careless or faulty packing, is decidedly below the standard required it will be deemed not to be covered by the guarantee, and the owner of such fruit may, at the option of the Minister, be held to have forfeited all right to participate in the guarantee for the remainder of the season.

2. EXPORT REGULATIONS.

The following regulations shall apply to all fruit—apples and/or pears, as the case may be—intended for export under the Government guarantee, 1926:—

GRADES AND VARIETIES.

"EXTRA FANCY" AND "FANCY" GRADES.

The standards shall be as set out in the Export Regulations of 1920, the principal requirements of which are as follows:—

Grade.	Colour.				Defects.
	Solid Red.	Partial Red.	Striped.	Yellow or Green.	
	Per Cent.	Per Cent.	Per Cent.		
Extra Fancy	75	50	33⅓	Good characteristic colour	No more than 8 per cent. of apples in case affected with slight blemish.
Fancy ..	50	25	20	Good characteristic colour	Apples not to be affected with more than 5 per cent. blemish or 5 per cent. unnatural russet.

Ten per cent. and 5 per cent. reduction in the above-mentioned colour requirements with respect to "Extra Fancy" and "Fancy" grades will be allowed in connection with fruit packed for European markets.

APPLES.

The following varieties of apples (which were accepted for export in the 1923 season), owing to their unsatisfactory carriage and out-turn, and the low prices realized in consequence of this or other unsuitable marketing characteristics, have since been omitted from the export list: Alfriston, Ballarat, Reinette du Canada, Washington.

The following have been omitted mainly on account of there being an insufficient quantity offering to warrant retention: Sharp's Late Red, Claygate Pearmain, Golden Russet, Scarlet Pearmain, Shepherd's Perfection.

The varieties marked with an asterisk in the following lists, although retained, are considered to be of little value for export purposes, and growers are advised to consider the reworking of these varieties, as well as those above mentioned, with a more suitable export variety. In the case of London Pippin the fruit must be hand graded and sized, and specially good of the variety.

APPROVED FOR EXPORT TO EUROPE.

Max. Size.	Variety.	Min. Size.	Max. Size.	Variety.	Min. Size.
		Solid Red Varieties.			
96	Baldwin*	225	110	Rokewood	240
96	Hoover*	225	96	Tasma	225
		Partial Red Varieties.			
110	Crofton	225	110	Scarlet Nonpareil ..	240
96	Delicious	225	110	Shorland Queen ..	225
110	Dougherty	255	96	Spitzenberg	225
110	John Sharp ..	225	110	Stark	225
110	Jonathan	240	110	Wagner	225
110	King David ..	240	110	Worcester Pearmain ..	225
96	Rome Beauty ..	225	110	Yates	255
		Striped Varieties.			
110	Adams Pearmain ..	225	120	Ribston Pippin ..	225
110	Allington Pippin* ..	225	110	Senator	225
120	Cox's Orange ..	255	110	Statesman	240
96	Premier	210	110	Stayman Winesap ..	210
		Yellow or Green Varieties.			
96	Boston Russet ..	225	96	London Pippin* ..	200
110	Brownlee's Russet ..	225	96	McMahon's White ..	225
110	Cleopatra	240	110	Newtown Pippin ..	240
96	Dunn's	210	96	Parlin's Beauty* ..	225
110	Golden Pippin ..	225	110	Sturmer	240
110	Grannie Smith ..	225	110	Willie Sharp ..	225
110	Gravenstein ..	225			

APPROVED FOR EXPORT TO SOUTH AMERICA.

Max. Size.	Variety.	Min. Size.	Max. Size.	Variety.	Min. Size.
		Solid Red Varieties.			
80	Baldwin	140	96	Rokewood	140
80	Hoover	140	64	Tasma	140

APPROVED FOR EXPORT TO SOUTH AMERICA—*continued.*

Max. Size.	Variety.	Min. Size.	Max. Size.	Variety.	Min. Size.
	Partial Red Varieties.				
96	Crofton	140	80	Scarlet Nonpareil ..	140
80	Delicious	140	80	Shepherd's Perfection	140
80	Dougherty	140	96	Shorland Queen ..	140
96	Jonathan	140	80	Spitzenberg	140
96	John Sharp ..	140	96	Stark	140
96	King David ..	140	96	Wagner	140
80	Rome Beauty ..	140	110	Yates	140
80	Salome	140			
	Striped Varieties.				
96	Adams Pearmain ..	140	96	Statesman	140
80	Premier	140	80	Stayman Winesap ..	140
80	Senator	140			
	Yellow or Green Varieties.				
96	Cleopatra	140	96	Sturmer	140
80	Dunn's	140			

SPECIAL CONDITIONS APPLYING TO EXPORT TO SOUTH AMERICA.

The modifications regarding colour standards allowed for European markets will not apply to apples for the South American market.

Grades: No fruit below the standard of "Fancy" grade as defined in the Export Regulations to be exported to South America.

"GOOD" GRADE.

Fruit packed in accordance with the requirements of "Good" grade may be exported to European markets only. The standard of the grade shall be as provided by the 1925 export conditions, the principal of which are:—

Grade.	Colour.				Defects.
	Solid Red.	Partial Red.	Striped.	Yellow or Green.	
Good ..	Per Cent. 30	Per Cent. 15	Per Cent. 10	Good characteristic colour	5 per cent. blemish or 15 per cent. unnatural russet.

The varieties for export under this grade shall be as set out in the European export list, excepting that the minimum size of any variety shall be not less than 210 apples per case, other than Cleopatra, Dougherty, Jonathan, King David, Sturmer, and Yates, the minimum size of which shall not be less than 225, and Cox's Orange 240 per case.

PEARS.

The following varieties are approved for export to Europe:—

Max. Size.	Variety.	Min. Size.	Max. Size.	Variety.	Min. Size.
In.		In.	In.		In.
$2\frac{3}{4}$	Josephine de Malines	$2\frac{1}{4}$	$2\frac{3}{4}$	Winter Cole	$2\frac{1}{4}$
$2\frac{3}{4}$	P. Barry	$2\frac{1}{4}$	$2\frac{3}{4}$	Winter Nelis.. ..	$2\frac{1}{4}$
$2\frac{3}{4}$	Packham's Triumph ..	$2\frac{1}{4}$			

Other varieties, up to 500 cases, may be approved for export for experimental purposes.

All pears must be of "Extra Fancy" or "Fancy" grades, and be packed in trays constructed as hereinafter provided.

REGISTERED EXPORT NUMBER.

The registered number issued to all growers under the Local Market Regulations will be declared to be the grower's registered export number also. The registered number of each grower must be branded on each case of fruit exported by him.

In respect to fruit packed by a packing organization to which a registered number has been allotted, such consignments may be marked with the registered number of the packing association only, provided that each grower's fruit is shown separately on the advice-note for examination, and stacked in separate lots, so that the Inspector may have no difficulty in determining which is the particular lot under examination. For example, a line of 100 cases of Cox's Orange coming from two different growers would be submitted as follows :—

Shipping-mark.	Registered Export Brand.	Total Number of Cases.	Variety.	Grade.	Number of Cases.	Pack.
345	P607	60	Cox's Orange ..	Fancy ..	14	163
			,, ..	,, ..	14	175
			,, ..	,, ..	8	188
			,, ..	,, ..	12	210
			,, ..	,, ..	12	225
345	P607	40	Cox's Orange ..	Fancy ..	8	163
			,, ..	,, ..	5	175
			,, ..	,, ..	7	188
			,, ..	,, ..	9	210
			,, ..	,, ..	11	225

These would be stacked separately in two lots and examined as different lines.

Should unavoidable circumstances prevent the adoption of this procedure, resulting in a line comprising a larger number of cases being submitted as one line, it must be definitely understood that the examination of same will be solely at the grower's risk, and in the event of any fruit forming a portion of the line being found to be unsatisfactory the whole line will be liable to rejection.

LABELLING AND MARKING.

A coloured label corresponding with that used in the 1925 season has been approved for use in connection with "Extra Fancy" and "Fancy" grade fruit. A non-coloured label of similar design has been approved in connection with "Good" grade fruit. All cases of fruit intended for export must bear a label on each end according to grade, as above indicated.

The marking of cases shall be in accordance with the 1925 season's requirements.

LABELS FOR TRAYS.

Special labels for use on apple and pear trays have been prepared, and will be procurable from the New Zealand Fruitgrowers' Federation.

WRAPPING-PAPER.

Apples of the various sizes as set out below shall be wrapped in paper of the size indicated opposite each respectively :—

Sizes 64's to 80's (both inclusive), paper 11 in. by 11 in.
Sizes 88's to 110's (both inclusive), paper 10 in. by 10 in.
Sizes 120's to 200's (both inclusive), paper 9 in. by 9 in.
Sizes 210's to 240's (both inclusive), paper 8 in. by 8 in.

In the event of the size of the paper used being smaller than that specified above for any respective size of apples, such apples shall be double-wrapped by overlapping two papers.

SPECIFICATIONS OF EXPORT CASE.

The timber recommended for the construction of an export fruit-case is white-pine of good quality, but *Pinus insignis*, rimu, and beech timber, if well and evenly cut, will be accepted. Owing to the unsatisfactory nature of cases constructed of poplar timber, cases of this class will not be approved for export.

The inside measurements of the export bushel case shall be 10 in. by $11\frac{1}{4}$ in. by $19\frac{3}{4}$ in.

Sizes of timber: The ends shall be made of boards of the following size—10 in. by $11\frac{1}{4}$ in. by $\frac{3}{4}$ in.; one-piece board at each end; both end boards to be planed on the outer side. The sides shall be made of boards of the following size—10 in. by $21\frac{1}{4}$ in. by $\frac{5}{16}$ in.; one or two boards optional for each side, provided that no side board shall be less than $4\frac{1}{4}$ in. in width. The tops and bottoms shall be made of boards of the following size—11 in. by $21\frac{1}{4}$ in. by $\frac{5}{16}$ in.; one or two boards optional, provided that no board used for the purpose is less than 5 in. in width. Provided that tops and bottoms may be made of boards of the following size—11 in. by $21\frac{1}{4}$ in. by $\frac{3}{16}$ in., to be used with the addition of four cleats per case, measuring 11 in. by $\frac{3}{4}$ in. by $\frac{5}{16}$ in.

In the event of two-piece sides being used in the construction of the case above referred to, the space between the boards shall not exceed $\frac{1}{4}$ in. In the event of two-piece tops and bottoms being used the space between such boards shall not exceed $\frac{1}{2}$ in.

Nailing: Nails used to be not less than $1\frac{1}{2}$ in. long, 14 gauge. Nails to be spaced not more than 3 in. apart, and the outer nails of each board to be not more than 1 in. from the edge of board.

Strapping: All cases to be strapped with a wire or steel band; such strapping to be tightly applied and to be not more than 1 in. from end of case.

CONSTRUCTION OF TRAYS.

Selected apples and pears may be exported in wooden trays having an inside measurement of $11\frac{1}{4}$ in. by $19\frac{3}{4}$ in., with depth from $2\frac{1}{2}$ in. to 3 in. Each tray to be complete with lid and label. Three trays to be securely wired together, forming one package. Binding-wires to be placed within 1 in. of each end of the package.

In the construction of trays the following is recommended: Bottom of bottom tray and top of top tray to be of two pieces, each $5\frac{1}{4}$ in. by $\frac{5}{16}$ in. Tops and bottoms in all other instances to be of two pieces, each $5\frac{1}{4}$ in. by $\frac{3}{16}$ in. Middle tray to have cleats across each end both top and bottom, thus requiring four cleats $\frac{3}{4}$ in. by $\frac{5}{16}$ in. by 11 in. Constructed in this way, bulge that takes place is inward, owing to the timber being lighter than the outer tops and bottoms. At the same time any such bulge is protected by the cleats, which also keep the trays apart, thus allowing for free ventilation.

CASES AND PACKING.

Specifications of the standard export case shall be strictly observed.

Corrugated strawboard or wood-wool shall be used on top and bottom of cases. All large fruit to be double-wrapped unless paper of sufficient size is used.

MINIMUM CONSIGNMENT.

Twenty cases of any one variety shall be the minimum consignment accepted for export.

Noxious Weeds.—The clearing of noxious weeds on Crown lands was given a considerable amount of attention during the year 1924–25, the larger grant provided by the Lands Department having allowed of this. A grant was also provided by the Native Department for the purpose of dealing to some extent with the large areas of unindividualized Native lands, and this money is being expended as authorized to the best advantage. The work in both cases is carried out by the Department of Agriculture.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COWS WITH UDDER TROUBLE AND FOOT-ROT.

"X.," Ohinepanea :—

(1.) I have two cows which have udder trouble. Symptoms: Quarter swells; milk goes away to nothing, but is of usual quality; cow loses condition and becomes weak in hind legs. (2.) I have several cows with foot-rot. Last year standing them in sheep-dip (carbolic) cured them, but this year it has not been efficacious so far. Can you suggest remedies?

The Live-stock Division :—

(1.) The cows are evidently affected with mammitis. It would be advisable to milk them last, and by hand, into a kerosene-tin containing a little Jeyes' fluid, and afterwards destroy the milk. Massage the quarters well, using a little camphorated oil as a lubricant, and strip each quarter as frequently as possible. Give each cow ¾ lb. Epsom salts and half a tablespoonful of ginger in a quart of oatmeal gruel sweetened with molasses. In such cases it is as well to forward a sample of milk from each affected quarter to the Officer in Charge, Veterinary Laboratory, Wallaceville, for microscopic examination. (2.) In treating cows with foot-rot, it is best to immerse the foot in a bath of hot water containing some antiseptic. Afterwards paint between the cleft of the hoof and around the hoof-head with strong tincture of iodine. A few dressings in this manner usually effect relief. A tar bandage made by applying a strip of calico smeared with Stockholm tar between the cleft and tied around the top of the hoof prevents dirt entering and further infection.

ARTIFICIAL CULTURES FOR LUCERNE INOCULATION.

FRANK REYNOLDS, Thornton :—

I am sowing about 6 acres of lucerne in the Rotorua district, and would like information regarding inoculation. I hear that there is a substitute for the inoculated soils that we used years ago. Will you please let me know if this is the case?

The Fields Division :—

The amount of field evidence we have regarding the efficacy of cultures in New Zealand is small. As far as the Auckland Province is concerned, we have carried out some pot experiments at Albany Experimental Area, and some field trials at Morrinsville with the culture named "Farmogerm." The trials have been carried on now for a period of two seasons (the present being the second season), and so far the lucerne treated with soil from an old lucerne stand is better than that where the seed was treated with the culture. It is evident, however, that the seed treatment with culture is quite good, and only suffers slightly in comparison with soil inoculation. Both the sets of treated plots are distinctly better than the control plots. The culture is mixed with the seed before sowing, and as it is put up in different sizes you should ask for enough for 6 acres.

HAND FEEDING OF YOUNG PIGS.

P. HODDER, Carterton :—

Please advise as to the hand feeding of young pigs from birth. I had a sow which had a litter and died the next day. I am at present feeding the little pigs with a teat on a bottle, and giving them as much as they can drink, about every two hours, of cow's milk and water, about half and half, with a tablespoonful of lime-water every feed among ten pigs.

The Live-stock Division :—

In general, rearing young pigs by hand on the bottle or a spoon is not a success ; it requires great patience and perseverance. It is not generally understood that a great difference exists between sow's milk and the substitute usually used—cow's milk. The butterfat globules of the sow's milk are one-quarter the size of those of cow's milk, but are in much larger numbers, allowing it (sow's milk) to be more easily digested. Cow's milk should not be diluted with water, as this makes the food a weak one. Milk from Jersey cows would be all right, but other milk of a lower butterfat content should be strengthened by the addition of a little cod-liver oil. The oil should be mixed with the milk at blood-temperature—a teaspoonful for a start and increased later. Lime-water can also be added at intervals. This will be sufficient until the pigs are three weeks old ; then a little meal may be added to the ration.

FRUITING OF APRICOT-TREES.

E. E. T., Whakatane :—

Do you know of anything to make apricot-trees bear fruit ? I have three seven-year-old trees ; they grow luxuriantly and have a few flowers, but no fruit. Would sulphate of iron or basic slag help them ? I have not pruned them for two years.

The Horticulture Division :—

The experience you are having with your apricot-trees is of the usual kind. In very few districts—and those usually of the driest—is the apricot-tree found to bear consistently. If the wood in the tree is very crowded, thin it out in winter, each branch removed being cut out at the base or just above a lateral. Follow this up by summer pruning. Applications of lime and phosphates would very possibly be beneficial ; the basic slag might be tried first.

DESTRUCTION OF GIANT FESCUE.

F. O., Wanganui :—

Can you inform me of the best method of destroying giant-fescue grass ? It lines a large portion of our pig-proof fences, and therefore to grub it out would be a lengthy job.

The Fields Division :—

Grubbing is the most effective way of clearing giant fescue. It could be destroyed, however, by spraying with an arsenic weed-destroyer. If you wish to make your own mixture, boil 1 lb. white arsenic and 2 lb. washing-soda in 1 gallon water. When fully dissolved, use at the rate of one part of solution to twenty of water. Spraying should be done on a dry day, and several sprayings will be necessary to kill the grass right out. As there is danger from poisoning, all stock would have to be kept off until after a good rain.

TOUGH MILKERS.

"INQUIRER," Pukeatua :—

I have a cow which is very tough to milk. Is there any instrument that could be inserted in the teats to make the holes larger, so that she would milk easier ? Any advice on this matter would be appreciated.

The Live-stock Division :—

There are few large commercial herds that do not include one or two cows that are hard to milk, owing partly to the contracted state of the sphincter and smallness of the orifices of the teats, or to a natural tendency on the part of some cows to hold their milk. There is an instrument that can be used, known as a milk or teat siphon, which is procurable at most chemists. It is inserted up each teat-duct, and the milk allowed to run off. It is inadvisable, however, to use such

an instrument unless absolutely necessary, owing to the danger of introducing bacterial infection causing mammitis. When used, it must be carefully sterilized by boiling for ten minutes each time before use, and in-between times kept in a clean place. It is much preferable to persevere with hand manipulation and observing regular milking-hours before resorting to the use of the instrument.

GRASS-MIXTURE FOR BUSH-BURN IN RAKAUNUI DISTRICT.

M. R. H., Eketahuna :—

I should like advice as to the best grass-seed mixture to sow on a burn of about 100 acres of second-class bush country, the bush being composed mostly of birch on the ridges, and tawa, konini, rata, hinau, and an odd rimu and totara, with plenty of supplejack. The land is sandstone and papa formation, and is inclined to go to scrub and piripiri after clearing. It is situated south of Rakaunui.

The Fields Division :—

The following mixture, sown immediately after the burn, should suit your purpose: Cocksfoot, 10 lb.; dogstail, 4 lb.; perennial rye-grass, 8 lb.; Italian rye-grass, 3 lb.; Waipu brown-top, 1 lb.; Danthonia pilosa, 2 lb.; subterranean clover, ¼ lb.; white clover, 1 lb.; Lotus major, ½ lb. In damper and richer parts reduce the cocksfoot to 6 lb. and replace the danthonia with 3 lb. meadow-foxtail and 2 lb. timothy.

SPAYED COWS COMING ON HEAT.

"WHAREPUNI," Tokomaru Bay :—

Would you be kind enough to advise whether spayed cows come on bulling? Last January we spayed a number of cows, but at present many of them are bulling.

The Live-stock Division :—

Spayed cows frequently come on heat at their usual period after the operation, and this may recur several times, especially if the cows have previously had calves.

DEALING WITH LUCERNE CROP FOR ENSILAGE.

J. C., The Hill, Feilding :—

I have a stand of lucerne, about 4 acres, doing fairly well. I cut it four times a year, but find it very difficult to make the first crop into hay. Could you please advise me what size silo I would require to make ensilage with one cut, and the cheapest and best way to make same?

The Fields Division :—

It seems doubtful if the first cut from 4 acres in your locality would yield sufficient to make an ensilage stack, but if the total weight is from 25 tons to 30 tons of green stuff this would permit of a stack 14 ft. by 14 ft. being made, which is the smallest size practicable. This method would probably be the most economical in your case, if only a small quantity is to be made each season. You might be well advised to provide a further small area of a suitable fodder each season to supplement the first cut from your lucerne area—preferably a carbonaceous crop or grass, as this mixture would make a better balanced ration. Should the stack method not suit your requirements, we would recommend excavating a cutting—say, 14 ft. by 14 ft.—in the side of a terrace. This can be conveniently filled by tipping the material from the top level, and is also easy to handle from the bottom level when carting out. With this method it would be desirable to timber the three earth walls as well as the front excavation, placing the planking perpendicularly in order to avoid resistance to the sinking of the material. Portion of the front wall should be constructed in sections to facilitate emptying the silo. Concrete could be substituted for timber if preferred, but sheet iron or steel is to be avoided in silo-construction owing to the corrosion which occurs from the acids in silage.

WEATHER RECORDS: DECEMBER AND CALENDAR YEAR 1925.

Dominion Meteorological Office.

GENERAL SUMMARY FOR DECEMBER.

WARM, dry, and windy weather was experienced during the month of December in most parts of the Dominion, but the contrast between the east coast of the North Island and the west coast of the South Island was most marked. The former had hardly any rainfall and suffered from drought, while the latter had much more than its large average, on account of deluges from two severe westerly storms, which particularly affected Westland and the Southern Alps. The snow melted on the mountains from the combined effect of warm rain and wind, and on the east coast of the South Island rivers were flooded through these factors without any local rainfall.

The first flood came from heavy rains which set in on the evening of the 3rd and continued on the 4th, the totals for the two days being 3·63 in. at Greymouth, 4·66 in. at Ross, 16·30 in. at Otira, and 10·98 in. at Arthur's Pass. For three days (9th, 10th, and 11th) the sums of the falls were 3·83 in. at Greymouth, 5·48 in. at Ross, 14·20 in. at Otira, and 11·88 in. at Arthur's Pass.

The rainfall was excessive along the high country from Tophouse to Queenstown, but deficient on the east side of the ranges. The vegetation of these regions shows a very pronounced and permanent demarcation, which is brought into notice by these two westerly storms.

There were other westerly disturbances during the month, and only one ex-tropical disturbance, which passed too far north to benefit Hawke's Bay. However, a thunderstorm there on New Year's Eve brought some temporary relief from a long spell of drought.

—*D. C. Bates, Director.*

RAINFALL FOR DECEMBER AND CALENDAR YEAR 1925 AT REPRESENTATIVE STATIONS.

Station.	December.				Calendar Year.	
	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1925.	Average Rainfall.
			North Island.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	1·50	5	0·48	3·28	50·56	50·87
Russell	2·10	5	1·03	2·05	56·48	48·85
Whangarei	1·88	8	0·80	2·49	57·29	60·24
Auckland	1·12	11	0·38	2·86	39·21	44·23
Hamilton	1·96	9	0·36	3·68	47·97	49·72
Kawhia	1·80	14	0·60	3·21	58·39	52·70
New Plymouth	3·02	14	0·93	4·28	55·05	60·16
Riversdale, Inglewood	3·93	14	0·83	7·43	95·53	104·48
Whangamomona	3·48	11	0·88	5·98	68·16	79·50
Tairua, Thames	1·56	6	0·52	4·30	54·93	65·85
Tauranga	1·90	8	1·30	3·35	52·73	53·28
Maraehako Station, Opotiki	0·80	6	0·54	2·82	55·79	50·77
Gisborne	0·76	2	0·41	2·13	41·64	47·05
Taupo	1·52	6	0·45	3·66	50·72	45·20
Napier	0·01	1	0·01	2·04	25·51	36·58
Maraekakaho, Hastings	0·58	2	0·50	2·21	30·18	34·77
Taihape	1·56	7	0·79	3·43	34·89	40·18
Masterton	0·55	6	0·31	2·57	36·94	38·83
Patea	1·55	9	0·55	3·35	39·87	44·05
Wanganui	1·01	4	0·54	2·63	25·79	36·86
Foxton	0·95	5	0·49	2·15	29·04	31·43
Wellington	2·13	11	0·71	3·31	52·17	48·24

RAINFALL FOR DECEMBER AND CALENDAR YEAR 1925—*continued.*

Station.	December.				Calendar Year.	
	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1925.	Average Rainfall.
South Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Westport	5·02	24	0·64	6·60	62·38	78·31
Greymouth	12·18	25	2·83	8·95	91·07	104·13
Hokitika	14·98	27	3·32	10·60	123·87	116·53
Ross	19·62	22	4·15	12·04	158·64	136·86
Arthur's Pass	32·05	18	10·08	12·02	179·16	147·11
Collingwood	4·38	17	1·21	8·01	91·90	99·81
Nelson	0·75	8	0·26	2·67	38·49	37·84
Spring Creek, Blenheim ..	0·74	8	0·30	1·93	31·13	30·31
Tophouse	7·55	19	2·15	5·00	68·81	60·78
Hanmer Springs ..	0·63	4	0·33	2·89	53·02	40·88
Highfield, Waiau ..	0·27	2	0·16	2·51	36·59	33·38
Gore Bay	2·80	3	1·88	2·12	35·88	31·63
Christchurch	1·03	7	0·76	2·03	33·42	25·28
Timaru	1·24	11	0·36	2·38	21·53	23·15
Lambrook, Fairlie ..	1·12	6	0·40	2·33	26·54	25·09
Benmore, Omarama ..	4·37	10	1·80	1·77	25·77	24·15
Oamaru	1·92	14	0·30	2·06	21·05	22·03
Queenstown	4·23	12	1·13	2·55	34·22	30·39
Clyde	1·61	11	0·70	1·79	16·85	15·03
Dunedin	2·24	18	0·35	3·50	39·88	35·95
Wendon	1·62	13	0·40	2·95	26·36	30·57
Invercargill	2·64	19	0·46	4·34	37·94	46·48

FORTHCOMING AGRICULTURAL SHOWS.

Waipukurau A. and P. Association: Waipukurau, 22nd January, 1926.
Horowhenua A. and P. Association: Levin, 26th and 27th January.
Rodney Agricultural Society: Warkworth, 6th February.
Te Awamutu A., P., and H. Association: Te Awamutu, 10th February.
Te Puke A. and P. Association: Te Puke, 10th February.
Dannevirke A. and P. Association: Dannevirke, 10th and 11th February.
Pahiatua A. and P. Association: Pahiatua, 13th February.
Masterton A. and P. Association: Solway, 16th and 17th February.
Whakatane A. and P. Association: Whakatane, 17th February.
Taumarunui A. and P. Association: Taumarunui, 17th February.
West Coast A., P., and I. Association: Greymouth, 17th and 18th February.
King-country Central A. and P. Association: Te Kuiti, 18th February.
Rotorua A. and P. Association: Rotorua, 19th and 20th February.
Northern Wairoa A. and P. Association: Mititai, 20th February.
Tauranga A. and P. Association: Tauranga, 24th February.
Ohura A., P., H., and I. Association: Nihoniho, 25th February.
North Kaipara Agricultural Association: Paparoa, 25th February.
Franklin A. and P. Association: Pukekohe, 26th and 27th February.
Omaha and Pakiri A. and H. Association: Leigh, 27th February.
Taranaki Metropolitan Agricultural Society: New Plymouth, 3rd and 4th March.
Waikato Central A. Association: Cambridge, 3rd and 4th March.
Opotiki A. and P. Association: Opotiki, 9th March.
Morrinsville A. and P. Society: Morrinsville, 10th March.
Hawke's Bay A. and P. Society: Autumn Show, Tomoana, 16th and 17th March.
Mayfield A. and P. Association: Mayfield, 20th March.
Methven A. and P. Association: Methven, 25th March.
Temuka and Geraldine A. and P. Association: Winchester, 25th March.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 19th November to 17th December, 1925, include the following of agricultural interest :—

No. 52417: Fencing-wires coupling; H. A. and V. G. Symes, Fairlie. No. 53366: Fruit-case-strengthening means; A. V. Allport, Stoke. No. 54148: Milking-machine teat-cup support; E. Sattler, Hurleyville. No. 54666: Milking-machine; A. Melotte, Remincourt, Belgium. No. 52704: Milking-machine pump, pulsator, and releaser; W. R. Cockburn, Auckland. No. 54851: Hair-removing from skins; S. Wilcox, Morgan, South Australia. No. 54556: Flax-tail cutter; C. J. Petersen, Foxton. No. 54936: Cultivator; A. C. Howard, Moss Vale, N.S.W. No. 55367: Harvesting-machine; W. Mitchell, East St. Kilda, Victoria.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price 1s.

IMPORTATION OF GRASS-SEED FROM AUSTRALIA.

THE regulations under the Stock Act relating to the importation of grass-seed from Australia made on 30th July, 1923, have been revoked, and the following regulations made in lieu thereof :—

1. For the purposes of these regulations the term "grass-seed" includes lucerne, clover, and millet seed.

2. The introduction of grass-seed grown in the State of Queensland or the tick-infestation quarantine area of New South Wales is prohibited.

3. Grass-seed grown in the State of New South Wales other than in the tick-infestation quarantine area may be imported into New Zealand subject to the following conditions: (*a*) That prior to shipment to the Dominion it has been subjected to fumigation by carbon bisulphide, at a strength of 10 lb. to 1,000 cubic feet of chamber-space, for a period not less than twenty-four hours; and (*b*) that it is accompanied by a certificate, signed by the consignor, in the form of the First Schedule hereto, and also by a certificate, signed by an officer of the Department of Agriculture of that State, in the form of the Second Schedule hereto.

4. Grass-seed grown in the States of Victoria, South Australia, Western Australia, and Tasmania may be imported into New Zealand subject to the production of a certificate, signed by the consignor, in the form of the Third Schedule hereto, and also a certificate, signed by an officer of the Department of Agriculture of the State in which it was grown, in the form of the Fourth Schedule hereto.

And it is hereby declared that these regulations shall come into force on the date of publication of this Order in the *New Zealand Gazette*.

The regulations were gazetted on 14th January, including the schedules referred to therein; the latter are not reprinted here.

BOOKS RECEIVED.

"CATTLE-BREEDING: PROCEEDINGS OF THE SCOTTISH CATTLE-BREEDING CONFERENCE." Edited by G. F. Finlay, Ph.D.; 495 pages; illustrated; price, 12s. 6d. net; Oliver and Boyd, Edinburgh and London. Consisting of the papers read at the Cattle-breeding Conference held at Edinburgh in 1924 (including several by British Dominions, United States, and European delegates). A valuable record of recent information and knowledge on many aspects of the subject.

"NEW ZEALAND FLOCK BOOK (SOUTH ISLAND)," vol. 21, 1925. Published by the Council of the New Zealand Sheep-breeders' Association (South Island), 151 Worcester Street, Christchurch. The latest issue of this standard publication.

SALE OF MILK FOR HUMAN CONSUMPTION.

REGULATION No. 21 of the regulations under the Dairy Industry Act, 1908, made on 24th December, 1900, has been revoked, and the following amending regulation substituted—taking effect from publication in the *Gazette* of 7th January :—

21. (*a*.) No person or company shall sell or offer for sale for human consumption any milk or cream other than that obtained from a registered dairy, but this provision shall not apply to any milk or cream sold or offered for sale for the manufacture of condensed milk, dried milk, butter, or cheese, or sold or offered for sale in the form of condensed milk, dried milk, butter, or cheese.

(*b*.) In any proceeding for breach of this regulation the onus of proof that such milk or cream was not milk or cream other than that obtained from a registered dairy shall be upon the person or company charged.

(*c*.) In any proceeding for breach of this regulation, if it be proved that any person or company carrying on the trade of purveyor of milk has during any period sold for human consumption milk or cream in excess of the quantities thereof proved to be obtained during that period by such person or company from registered dairies or in the possession of such person or company at the commencement of the period, such proof shall be *prima facie* evidence of a breach by such person or company of the provisions of this regulation, notwithstanding that no evidence may be tendered of any specific sale of milk or cream other than that obtained from a registered dairy.

ENTRY OF STOCK INTO CLIFTON COUNTY.

THE following regulations under the Stock Act, governing the entry of stock into Clifton County on its northern boundary, were gazetted on 23rd December, 1925, and came into force on that date :—

1. For the purposes of these regulations " stock " means live cattle, horses, and dogs ; " officer in charge " means the officer in charge of the dip hereinafter referred to.
2. All stock entering the Clifton County on its northern boundary shall cross the Mokau River at what is generally known as Mokau Ferry.
3. After crossing the Mokau River and reaching a point of approximately three miles south thereof on the Auckland-Wellington (via Taranaki) Main Road, all stock shall be dipped in the dip erected adjacent to such road on part of the property known as the Mohakatino Station ; provided that in the case of horses, the officer in charge may authorize them to be sprayed in lieu of being dipped.
4. After being dipped or sprayed no stock shall be moved from the holding paddocks, except with the written permission of the officer in charge, and it shall be deemed to be an offence against these regulations if any stock are moved without such written permission.
5. The fees payable in respect of stock dipped or sprayed shall be : Cattle and horses, 6d. per head ; dogs, no charge.
6. All fees shall be payable at the time of dipping to the officer in charge.

Australian Agricultural Machinery.—Mr. J. W. Deem, who visited Australia recently, was much impressed by the fine display of locally manufactured agricultural machinery at the Melbourne Royal Show. He states that the machinery in connection with the growing and harvesting of wheat was especially good. It was noticed that a considerable proportion of this was made for use with tractors. Cultivators, harvesters, binders, and drills were very prominent in this respect, one of the drills, containing twenty-eight coulters, being of particular interest. An implement which is fast coming into prominence is the manure-spreader. It is said that more of these have been sold during the last two or three years in Australia than ever before.

New Rabbit District.—The constituting of the " Marlborough Coast Rabbit District " for the purpose of Part III of the Rabbit Nuisance Amendment Act, 1918, was published (with details of boundaries) in the *Gazette* of 7th January.

The New Zealand

Journal of Agriculture.

VOL. XXXII. WELLINGTON, 20th FEBRUARY, 1926. No. 2.

SOME OBSERVATIONS ON CONTAGIOUS MAMMITIS IN DAIRY COWS.

C. S. M. HOPKIRK, B.V.Sc. (Melb.), Officer in Charge, Veterinary Laboratory, Wallaceville.

THE present time appears to be opportune for offering a few observations on the disease contagious mammitis, a subject which is attracting attention throughout the dairying districts of New Zealand, having been brought to the fore by the various cures and prophylactics on the market, more especially by the use of vaccines. These observations are based on the examination of thousands of samples from New Zealand cows, on cultural work in the laboratory, and on watching the course of the disease in experimental animals—giving confidence to express an opinion on many points met with.

CAUSE.

It may be remarked in the first place that the name "contagious mammitis" is really a misnomer, as it will not be contested by any veterinary practitioner that all forms are contagious given certain conditions. Mammitis may be caused by several species of organisms, either singly or together, those which have been definitely found in New Zealand being streptococci, a staphylococcus, and two forms of rod-shaped bacteria. We may ignore the rod-shaped group, and consider the remaining two. Staphylococci are frequently found in the undrawn milk of cows, lying harmlessly in the large milk-sinuses. Staphylococci and the bacillus of abortion, according to one authority, are found more often than are streptococci or chain forms, but this has not been our experience in New Zealand. When inflammation of the quarter has actually developed it is not very frequently the staphylococcus which is found to be present. Occasionally the writer has come across this organism in pure culture, more particularly with goats. Whenever alone causative, it is found in large numbers in the samples submitted, and is obtained in pure culture from the sample taken in aseptic manner. The streptococcus, on the other hand, is far and away the most frequent type to be met with here.

Now, several different varieties of streptococci may be found in mammitis, and the streptococcic form is that which we are used to

hearing called "contagious mammitis." It is known that even the streptococcus of sour milk may set up mammitis, and it appears certain from experimental work that there is a particular streptococcus from the droppings of cows which frequently causes a less virulent form of the disease. The most typical variety, however, is that known as *Streptococcus mastitidis*, which has definite reactions in culture media.

The virulence of the organism found in any one outbreak of the disease is a factor when it comes to controlling that outbreak, but the biggest factor is that of injury to the udder. Injury may be brought about in many and various ways, among which may be enumerated chills, calving, horning, kicks, falls, possibly septic metritis, cow-pox, rough handling of udder, irregular milking, heavy production, and overstocking with milk before calving, but, above all, to machine milking. Certainly contagious mammitis was known before machine milking, but not to the extraordinary extent that it is known to-day through injurious and careless use of the machines. A machine correctly handled is not a source of danger, but undue increase of vacuum, failure to understand the individual peculiarities of all cows in the herd, and also the difficulty with many farmers to keep their machines scrupulously clean, tend by continuous irritation and by combining the two necessary factors in this disease—dirt containing the streptococcus and local injury—to be the source of apparently violent outbreaks of contagious mammitis.

To recapitulate, we have three factors—the streptococcus which is apparently ubiquitous in cow-sheds, the virulence of that organism in a given outbreak, and thirdly, of most importance, injury to the delicate tissues of the quarter.

COURSE OF THE DISEASE.

The majority of cases of contagious mammitis commence as noticeable acute inflammatory reactions in one or more quarters of the udder. In this quarter one usually gets a sudden change in the milk owing to the large number of invading wandering cells from the blood-stream, and owing to an inflow of lymph which will alter the reaction of the milk. In the worst cases inflammation stops the milk-secretion to a large extent, and in place of milk one gets yellow fibrinous clots and an amber-coloured fluid. In milder cases a deposit of cells is found at the bottom of the sample to be examined, the secretion having retained its milky colour to some extent but appearing thin and watery. There is, however, another form which occurs commonly and which is annoying when curative measures are adopted; it is also annoying to the examiner of the sample in that, unless a thorough history of the cow is supplied, he is not absolutely sure of his diagnosis without ample experience; moreover, it is dangerous in that the condition is often not recognized by the milker. By this is meant the common chill which persists as a more or less subacute form of the disease for some considerable time. This type does not flare up into an acute attack when first attacking the quarter, and is, the writer believes, a combination of slight injury to the quarter and slight virulence of the organism. Of recent years this type has been common. But let a quarter such as this be left without milking—as during the drying-off period—then

the disease may often flare up and assume every indication of a really acute form.

Streptococcic mammitis runs one of several courses. In one the number of cells quickly subsides, and the milk reassumes a normal state to the naked eye. This may be due to the individual resistance of the cow or to the fact that a less virulent species of the streptococcus has gained entrance to the quarter. In another form of outbreak the quarters quickly become dry, the fat-cells are ruined, and the quarter becomes hard and fibrous, never again becoming quite normal, although at next lactation there may be some return to milk. A third type results in a fibrous lump forming at the base of the teat-sinus—the popular "pea in the teat." Yet another case will continue to give a secretion rich in inflammatory cells, and obviously affected with the disease, for months or even throughout the animal's lactation period. All these cases harbour the streptococcus.

Where a staphylococcus is found in pure culture or in a rich combination with the streptococcus in an acute case there is often abscess-formation and sloughing of the quarter. When an attack has been running its course for some time one finds that the infection becomes mixed—that is, streptococci are joined by staphylococci, which may help to prolong the condition.

A large number of cases of contagious mammitis appear themselves to subside, with or without treatment, into what may be called a chronic state, in which one gets a few inflammatory cells always present in the cream on standing, and in which cells one may often see microscopically an engulfed streptococcus. These cases — and the writer believes them to be the majority of cases of contagious mammitis—last usually throughout that particular lactation period. Once, however, the cow has dried off successfully without a recurrence of the acute form, the streptococcus, which has been lying almost latent, dies out, and the cow usually comes in with a sound quarter. She may not, of course, give the old quantity of milk, but what she gives is wholesome. As it requires the microscope to demonstrate the case of these cows, and as they are perfectly normal to all outward appearance, the farmer may well understand how dangerous they are in his herd. It is such cows which keep up the incidence of mammitis in the herd.

To show that this view of chronic mammitis is correct an actual instance may be given. Ten cows were known to have had contagious mammitis in definite quarters in the past two to six months, and then, giving only an odd inflammatory cell in the milk, were left over two milkings, except where easement was given to one or two animals which were becoming overstocked. The collection of milk at body-temperature gave the organisms lying latent an opportunity to propagate under ideal conditions. In whichever quarters these cows had had mammitis it was observed that they had a recurrence in the form of a very acute attack, and, what was more significant, only in those same quarters. The previously normal quarters remained normal. The obvious conclusion is that the affected quarters should either have a treatment given which might kill the streptococcus, or else that such quarters should be dried off.

TREATMENT.

The matter of treatment may be dealt with under two heads—namely, curative methods and prevention.

Curative methods so far have not been as successful as might be expected, and many drugs have been tried. The ideal is a drug which could be easily administered and which would be excreted by the udder without harming the cow, but would have a selective harmful action on bacterial life only. No drug of this nature has yet been discovered. Failing such a drug, one can try the next best method, and that the writer believes to be pumping in or otherwise introducing a disinfectant in gaseous form. Provided the disease is taken in time, and the quarter thoroughly stripped by massage to remove clots, some good results have been obtained in many cases by such methods, but even then at least two treatments are found to be more satisfactory, with an interval of about three days between them. There are cures on the market embodying this principle, but even the best of these cannot be held as "cure-alls."

Prevention is truly better than cure. The farmer to a large extent has this in his own hands, and the methods are cleanliness of the shed and utensils, care in handling the cows and milking-machines, and care in buying in cows for the herd. There are many herds throughout the country which never or rarely contract mammitis. Hand-milked herds—including many pedigree herds which do not risk machines, or, if they use them, do so with scrupulous care—often enjoy a welcome freedom from the disease. This is largely due to milking each cow as she requires to be milked, and not treating every one as a machine built on the same pattern.

VACCINES.

The preventive method now before dairy-farmers in the form of vaccine is still in the experimental stage. If inoculation is a means of protecting the majority of cows from mammitis, then one would expect that cows which are actually or chronically affected, and which therefore harbour many millions of organisms, should produce in themselves sufficient immunity to protect themselves from the ravages of the organism in a second quarter. One knows, however, that it is just as easy for a cow already affected in one quarter to be later affected in a second as it is for the primary infection to become established, and that although protective antibodies are produced they are not sufficient to keep the cow from becoming infected. This fact is a definite contradiction to the use of vaccine in connection with streptococcic mammitis.

Experimental work at this Laboratory has given us no feeling of security with the vaccines now in local use. It is said by the advocates of vaccine that the artificial inoculation of the disease into the udder for the purpose of testing is too severe to show protection or otherwise of a vaccine. Suppose, for argument's sake, that this is granted, yet the experiments are particularly valuable in that they show that the length of time for which animals remain affected is not greater in non-vaccinated control animals than in vaccinated, and surely the vaccinated should clean up very much quicker. This is also, to the writer's mind, another point which cannot be overlooked by advocates of the vaccine

method of prevention. Much capital has been made of this Department's method of experimentation, but even though the primary dosage directly placed in the udder was higher than would be the case with natural infection, yet if the control cows can throw off infection as quickly and as effectively as vaccinated cows it is obvious that the vaccinated cows are not benefited to any noticeable extent by the vaccine.

It is not only in the experimental work at Wallaceville and at Ruakura but in the field that we find the vaccine has not been effective in producing the necessary immunity to protect herds. A mass of information has been obtained by officers of the Department, and they find that in a great many cases the cows vaccinated have not received sufficient immunity to prevent infection. This is particularly noticeable in the Wairarapa, and this district, owing to shortage of rain, has not had the flush of milk in the current season which some other districts have had, and without this flush of milk we could not expect the same prevalence of mammitis.

There is a blood test (the agglutination test) which can be applied to a cow's blood to show what amount of a certain antibody is set up by the presence of the streptococci in the system of a cow. The amount set up in experimental vaccinated cows was found to be very much less than where the cows were affected with the chronic form of the disease, these latter cows not having been vaccinated. This would tend to show that a cow chronically affected has a better opportunity of withstanding further invasion by the disease, but, as was stated before, such cows often do become infected in a further quarter. How much easier, then, would it be for the vaccinated cow, with less immunity, to take the disease.

CONCLUSION.

There is one great danger which the farmer should be warned against, and that is the laxity which may follow his belief in a preventive agent against contagious mammitis. Sooner or later he may receive a severe lesson. Should he, on the other hand, knowing the widespread nature of the organism of the disease, keep up strenuous endeavours by cleanliness and watchfulness to avoid his cows becoming infected, then he will correspondingly benefit. The farmer who will have least trouble is he who milks carefully to avoid injury, builds up the system of his cows by good feeding and suitable top-dressing of his land to withstand disease, keeps his utensils clean, avoids risks of infection by strict antiseptic precautions, and buys in only cows free from diseases of the udder.

The presence of certain plants, particularly English trefoil, is a sure indication that the soil is suitable for lucerne-growing. Lucerne requires large quantities of lime, and where the soil is deficient liming must be carried out.

The greater the proportion of total feed consumed by the dairy cow available for production the greater the gross value of every ton consumed. A 150 lb. butterfat cow consumes 15 tons of grass, returning 15s. per ton with butterfat at 1s. 6d. per pound; a 300 lb. cow consumes 20 tons, returning 30s. per ton. Adequate feeding always pays.

MINERAL ELEMENTS IN THE FEEDING OF STOCK.

(Continued from December issue.)

B. C. Aston, F.N.Z.Inst., Chemist to the Department of Agriculture.

Calcium and phosphorus are the two mineral elements contained in the greatest amounts in the bodies of all domestic animals. Calcium, it should be stated, is the metal of which lime is the oxide. Quicklime is merely the metal combined with oxygen (which exists freely in the atmosphere), and is analogous to the oxides of other metals, that of iron, for instance, being called rust. Phosphorus, as is well known to many farmers who poison rabbits, is an extremely unstable, non-metallic element spontaneously igniting in air to form oxides, one of which, phosphoric acid, quickly combines in the presence of water with any suitable oxide of a metal to form a phosphate.

It is either one or both of these elements—calcium and phosphorus—which are the most likely of all to be deficient in the diet. Furthermore, it is in special cases in which certain animals which have been highly developed by artificial selection for special purposes that the deficiency often appears. Thus, some breeds of pigs will increase in weight from 2 lb. to 2 cwt. in six months; there are dairy cows which yield in their milk from 10 lb. to 12 lb. of solid matter per day; there are hens which will lay two to three hundred eggs in a year. (Orr.) The demand of such animals for large quantities of energy foods is readily recognized by the fortunate owner, but the necessity for providing an adequate supply of mineral foods is not always realized, nor is it recognized that although plenty of food is given it may not contain enough of the necessary minerals. It may be easier to see that a hen will require quite a large amount of lime to form two or three hundred egg-shells in a year, and for this purpose calcareous foods and grits are, of course, given; but it is not so easy for the farmer to realize that for every 500 gallons of milk sent off the farm there is being sent away 9 lb. of phosphoric acid, or the amount which would be found in ½ cwt. of ordinary superphosphate.

Of course, in economical working much of the phosphate is given in the skim-milk to pigs, and is used by them to build up their quickly growing bodies. The amount of phosphate contained in each pig's body must be allowed for and imported on to the farm. A portion in the excreta of the stock passes back into the soil. Little mineral matter is contained in the cream sent off the farm, so that when this is the practice, and if the excreta of the animals can be properly redistributed (an ideal seldom realized), the home separation section of the dairy industry should be the one which impoverishes the land in minerals the least of any, butterfat consisting of carbon, hydrogen, and oxygen, which are in the first place entirely derived from water or the gases of the atmosphere. As at present conducted, however, one must consider dairying as a form of intensive farming which requires constant application of minerals—particularly phosphates—to the pasture.

What takes place when the elements calcium and phosphorus are deficient in the pasture is that the animal supplies the deficient element from its own bones to make milk or to carry on the body-changes for which phosphates are essential. There is, however, a limit to this store of phosphate, and soon a crisis is reached when the bones themselves, having given up all the reserve store of phosphates, are finally so depleted that malnutrition of the bones appears. This, commencing with soreness of the joints, is followed up by degeneration of the bony structure, the animal becoming a pitiable sight with a limping and unnatural gait. This condition is relieved by medicinally treating the animal with phosphates, or more slowly by top-dressing the pasture with phosphate if there is sufficient rain to carry the phosphates to the plant. In sheep, the bones may actually break when handling the animal.

The importance of giving a salt lick to all farm animals is universally recognized. There may be some areas near the sea where this practice is unnecessary, and the animals will probably refuse to lick the salt. Among other functions salt supplies sodium and chlorine, both essential mineral foods. It is supposed that the sodium assists in the elimination of potassium, which exists in such abundance in all green pasture and especially in the young growing grass. The potassium is excreted in the urine by stock, and is thus largely returned to the pasture whence it was derived. No case of potassium being deficient is on record, though an excess of it may be injurious, and there is at least one instance attributable to this cause in the literature of the subject. The chlorine is required by the animal to make hydrochloric acid, which is the acid of the digestive juice. It is not possible to say whether recognizable symptoms are peculiar to and would follow a deficient supply of salt, but a supply of salt lick will usually be found beneficial in promoting an increased thriftiness and condition in stock, while the reverse of this may be the case if salt is withheld.

The function of magnesium in the animal economy is not definitely known. The amount present in milk is relatively small; apparently in animal nutrition it bears the same relation to calcium as potassium does to sodium. Professor John Malcolm has shown that the introduction of soluble magnesium salts into adult animals causes a loss of calcium. Abderhalden states that in osteomalacia, a form of bone malnutrition, a certain antagonism between calcium and magnesium salts has come to be recognized.

Iron, although present in small quantities compared to the other mineral elements in the animal-body, is none the less essential, and when deficient gives rise to symptoms which are unmistakable. It has been found that sows fed on a diet deficient in iron produced young which suffered from iron-starvation, which was attributable to a lack of iron in the milk (McGowan and Crichton, *Biochemical Journal*, No. 1, 1924). The distinction in the symptoms of a ruminant suffering from deficiency of phosphates and another from deficiency of iron is well marked. In the case of phosphates it is the bones which show signs of being affected. In the case of iron the blood is deficient and the animal anæmic (showing lack of blood). The bones of such an animal are quite normal, and there is no soreness of the joints causing

the animal to limp. It is fortunate that these deficiency diseases which are commonest in New Zealand are so well marked in their symptoms as to be unmistakable.

There are other elements, such as fluorine, iodine, manganese, copper, zinc, and arsenic, which are normally found only in traces in the bodies of animals, and most of them are now held to be essential in small quantities. Farmers will be familiar with all of these except fluorine and manganese. Fluorine is the lightest member of the group of elements called the halogens or "acid-makers." Chlorine, as stated, is necessary to make the digestive-acid juice, hydrochloric acid, the other members being bromine and iodine. Fluorine is a colourless gas, and it is always found in the bones and teeth of animals in the combined state. Iodine is an element which has come into great prominence in connection with the cure of goitre. No extensive deficiency in New Zealand domestic animals has been observed which might be attributed to deficiency of iodine. Isolated cases of goitre have, however, been observed in dogs and horses.

Manganese is abundantly distributed in all parts of New Zealand in the soil and pasture. There is no suspicion of its being deficient. In some places it may be in excess. Where this is so it is likely to be met with in the form of a black compound, the dioxide of manganese sometimes found in the form of black nodules in the soil.

MEDICINAL MIXTURES AS LICKS.

The question which will immediately occur to the reader is, Cannot any minerals found deficient be supplied in the form of a lick? The writer went into this aspect of the matter when in England, and cannot do better than quote from Dr. Orr on this matter. He states in "Importance of Mineral Matter in Nutrition," under the heading of "The Value of Salt Mixtures,"—

"During the last two or three years various salt mixtures have been advocated, and some put on the market. It must be obvious to the intelligent reader that, though these may do good in some cases, they do not solve all the difficulties of an adequate mineral-supply. In some cases, indeed, they may do harm. For example, a salt mixture rich in phosphorus would show excellent results if added to a ration poor in phosphorus, but would do harm if added to one with a surplus of phosphorus. Salt mixtures intended to be used in a routine way with all the different kinds of rations likely to be fed are quack remedies of doubtful value. There is no short-cut to the perfect feeding of animals. The feeder must know the requirements of his animals, and the extent to which different feeding-stuffs will meet their requirements, and then arrange rations accordingly. The research worker may ultimately be able to supply him with the necessary technical information to do this. But he will never be able to supply him with a salt mixture that will relieve him of the necessity for making his own calculations and coming to his own decisions as to what is best for the animal in each case. Indeed, that is where the skill and experience of the feeder comes into play."

This must not be taken to imply that rock salt or licks supplying common salt alone should not be used. This is a farm practice which

has proved itself and has now become general. Neither must it be taken that if iodine or any other element is found deficient it must not be supplied in lick form. Each case must be decided on a knowledge of all the circumstances, but it is unlikely that a general lick for all cases will be found satisfactory.

2. DRINKING-WATER.

In the December issue of the *Journal* it was shown that the substances eaten by stock could be classified into two groups—namely, those which by their oxidation in the animal supplied it with warmth and energy, and others, the no-less-important non-combustible or mineral ingredients of the food, which, although not supplying warmth and energy, were true foods, and as vitally essential to the health and growth of the animal as the combustible compounds of carbon, hydrogen, nitrogen, and sulphur comprising the first group.

There is another substance, however, which, although neither a combustible material nor a mineral food, is swallowed in large quantity and is just as necessary to the well-being of the animals as either of the above groups—namely, water.

The necessity for water is so generally recognized that the books on feeding say little about the necessity for a good, pure, permanent supply of drinking-water for stock on the farm. So essential is water that if stock were wholly deprived of it they would die quicker than if they were given plenty of water and wholly deprived of food. (Green pasture contains 75 per cent. of water, so that this is really a mixture of food and water.)

Water plays a very important part in the animal economy; about two-thirds of the weight of the body consists of water, and every cell, to be kept at a definite consistency, must contain water, which the organism requires for a number of different purposes. Water facilitates the chewing and swallowing of the food; when the food is digested, water is necessary to dilute the products and enable the soluble nutrient bodies which have been formed to be absorbed. Should the solution of these be too concentrated it will not penetrate the walls of the alimentary tract, but rather will draw water from them, causing increased movement of the intestines (peristalsis), premature evacuation, and hence loss of unabsorbed nutrients. Water serves as a transporting agent of the nutrients in the blood and lymph vessels, and also carries off much of the final waste products which the organism produces. By evaporation from the skin and lungs water provides the animal with the most valuable means of regulating the temperature of the body. If sufficient water is not present in the body to cool it by bedewing it with perspiration fatal overheating may occur after severe muscular work or overfeeding.

Observations on men and animals show that when water is deficient gastric digestion and absorption of digested substances are hindered; nitrogenous products are not sufficiently rapidly excreted from the body. In continued lack of water the blood thickens and the temperature rises; a condition similar to fever then occurs, and young growing animals can easily be injured in their development by even a moderate lack of water or by irregular watering. On the other hand, there is

little fear of animals receiving too much water unless they are given excessive quantities of watery foods, or too great a thirst is induced by the eating of large quantities of salt.

If the deficiency of drinking-water becomes too acute the result may lead to digestive disorders in stock. In cattle, impaction of the rumen may occur when the weather is dry and water scarce. When this condition arises and becomes chronic a plentiful supply of drinking-water must be available for its proper treatment. Insufficient drinking-water of indifferent quality, which the stock will not freely drink, materially assists in producing impaction of the rumen. Lack of water is a potent source of constipation in stock, and the drinking of impure water is responsible in some cases for diarrhœa. Water contaminated by mineral irritants (sheep-dip, &c.) may provoke inflammation.

In experiments where animals have been allowed to drink as much water as they wish the quantity relative to the dry matter eaten is found to be fairly constant. For 2⅕ lb. (1 kilogram) of dry matter pigs were found to consume seven to eight times, cows four to six times, oxen four to five times, and horses two to three times the amount of dry matter taken. Large quantities of very cold water given all at once are not so useful as smaller quantities given throughout the day. The water, if feasible, should be at a temperature of from 50° to 60° F., and it is desirable that it be chosen from as pure a source as possible.

It is important that a plentiful and good supply of drinking-water should be provided for milking-cows, more especially in the hot summer weather, in order that the animals should yield well. According to Geneva (New York) experiments with seven breeds, about 5 lb. of water are required for every 1 lb. of milk yielded. In this country of abounding water it would be regrettable were the shortage of drinking-water to constitute one of the factors in diminishing the milk-yields, but it is feared that the matter has not always received the consideration which the importance of the subject warrants. The following articles published in this *Journal* may be referred to: "Water-suppply on the Farm: Utilizing Springs," by J. D. Ritchie (Vol. 12, p. 361, 1916); and "Concrete Water-tanks," by the Public Works Department (Vol. 20, p. 114, 1920).

(To be continued.)

Noxious Weeds Orders.—The Lake County Council has declared broom and gorse to be noxious weeds within that county; Pohangina County has similarly declared foxglove.

Reconditioning a Galvanized-iron Tank.—A correspondent asks for advice in repairing a galvanized corrugated-iron tank that is becoming full of pinholes. The following method will be found effective: Make a cement wash by mixing pure cement and water to a consistency of an ordinary whitewash preparation. Apply three coats to the interior of the tank-walls, allowing each coat to dry before applying the succeeding one. When the walls are dry, pour the wash into the bottom of the tank to the depth of ¾ in., and stir well to free from bubbles. Care must be taken to keep the sun off the tank while drying, as heat will at once disintegrate the cement-particles when in the drying stage, the cement falling away as a powder. If care is taken in this respect during treatment the tank should be good for several years' use.

WALNUT-CULTURE.

SOME NOTES ON HAWKE'S BAY GROVES.

W. C. HYDE, Horticulturist, Horticulture Division.

IN order to meet the growing demand in this Dominion for nuts, importers increased their purchases of foreign nuts for the year 1924 to a total value of £81,000, the estimated value being that in the country of origin at the time of export plus 10 per cent. The inquiries received from growers in different parts of the Dominion show that they also are taking an interest in this demand, especially the walnut section of it.

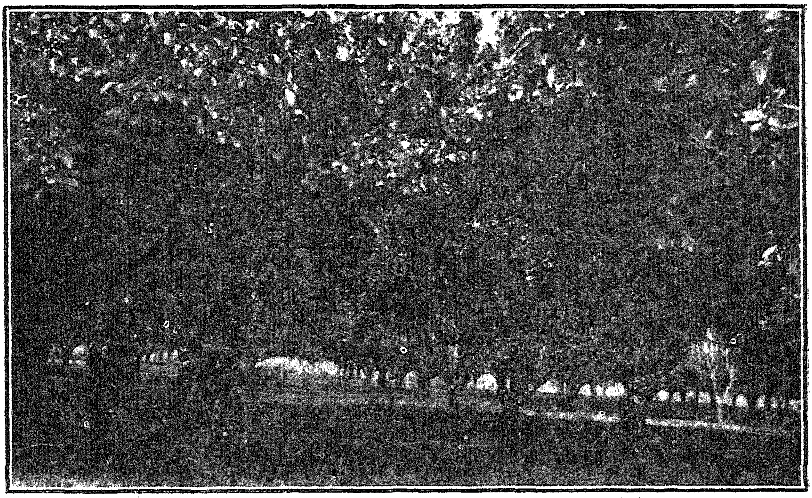


FIG. 1. WALNUT GROVE AT RIVERSLEA, HASTINGS.
These trees are 40 ft. apart and twenty-eight years old.

With a view to obtaining a better estimate of the well-known difficulties which the walnut-growers in the Dominion have to meet, a special inspection was made recently of the walnut groves in Hawke's Bay. One of the largest there is that on the Riverslea Estate, belonging to Mr. E. H. Williams. The main grove is $5\frac{1}{3}$ acres in extent, the land being a good well-drained alluvial loam, and the trees seedlings planted twenty-eight years ago at a distance of 40 ft. between trees and rows. About an equal number of trees are distributed round orchard headlands and employed in forming a considerable avenue. These trees, two to three hundred in number, afford many interesting comparisons.

While the Riverslea crop this season generally is heavy, a few trees, though in usual health, are carrying a very small crop. Others again have exceptional loads. As regards the walnut-blight (*Pseudomonas*

juglandis) that is the despair of so many growers (infecting the crop in early spring and ruining the young nuts before they can develop), it was at first supposed not to be present, but just before the inspection was completed one tree was found with practically the whole crop rather badly affected. The health of the other trees in the grove was excellent and the nuts fully developed, but, of course, immature.

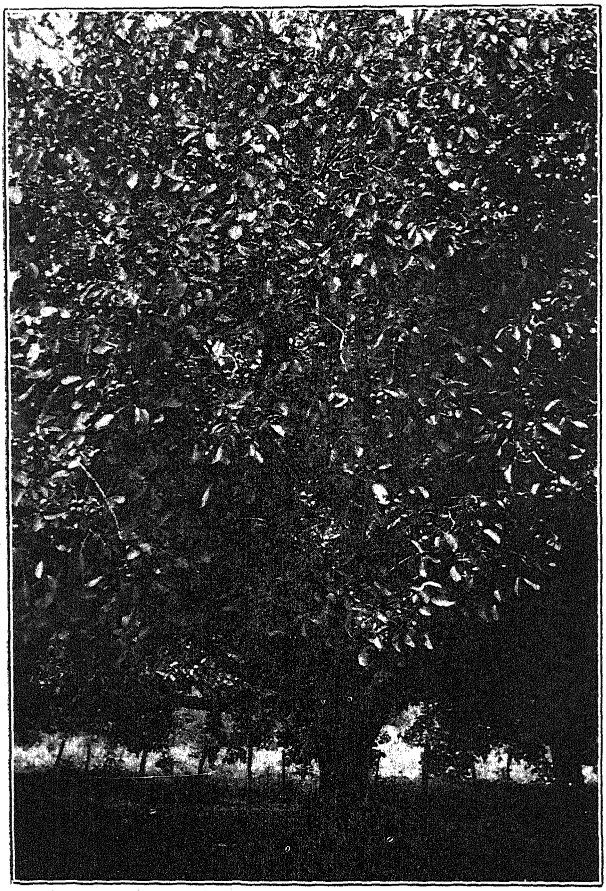


FIG. 2. WALNUT-TREE AT RIVERSLEA, SHOWING THE ADVANTAGE OF WIDE SPACING.

This tree, having the advantage of being next to a gap in the rows, is carrying a heavy crop round the sides as well as the top.

Inquiry brought out the fact that this bacterial trouble, which fails to respond to sprays and ordinary treatment, varies greatly in the severity of its attack.

Although the crop at Riverslea this year is practically clean, in other seasons the proportion of loss has been very high. The best

conditions appear to be a wet winter and a dry spring, when trees on such land as this may be expected to make a good return. Yet in the worst seasons for walnut-blight two or three trees in this grove can be relied upon to ripen their crop 90 per cent. clean. These remarks apply to the so-called English walnut, which forms practically the whole of the planting. A few Japanese walnuts, showing great

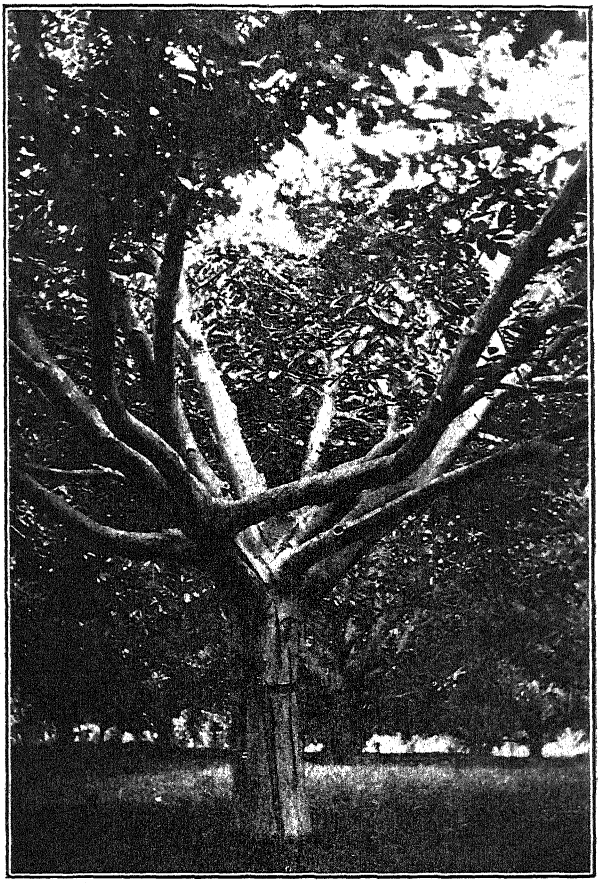


FIG. 3. WALNUT-TREE AT RIVERSLEA, SHOWING THE METHOD OF TRAINING THAT HAS GENERALLY BEEN ADOPTED.

vigour and carrying fair crops here, have never been known to be affected with this disease in the experience of the present manager. Unfortunately, the kernels are so small and difficult to extract from the exceptionally hard shells that they are not a commercial product.

A number of other groves visited on the Heretaunga Plain, and carefully inspected, endorsed the foregoing evidence. Heavy, clean

crops were the rule, and not another badly blighted tree was found, although owners admitted that in some seasons the crop was a serious loss.

The practice generally has been to obtain seedling trees from the nursery, where they have been grown from seed obtained from a tree selected for its constitution and the quality of its nuts. In view of the increasing commercial importance of this crop and the more ex-

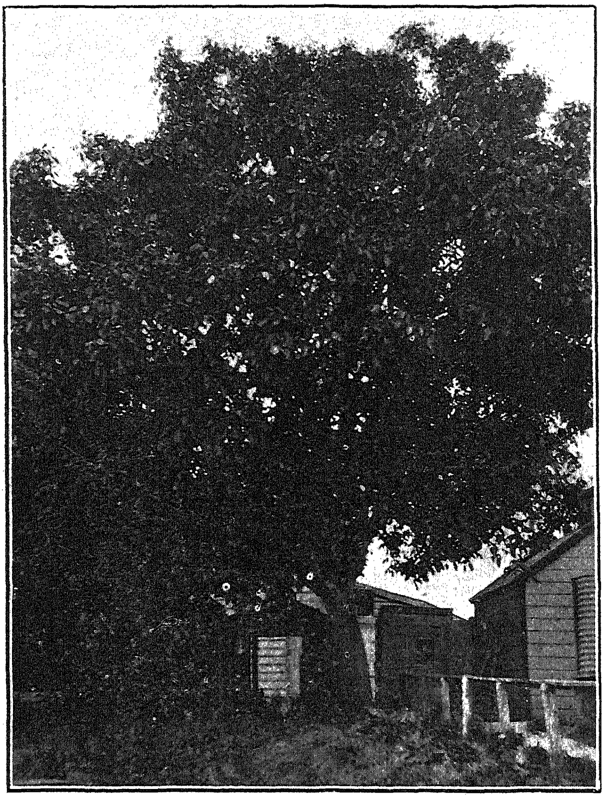


FIG. 4. WALNUT-TREE AT J. TAYLOR'S ORCHARD, HAVELOCK NORTH.

A good cropper of excellent nuts, used as seed for commercial propagation.

tended planting taking place, it would doubtless be wise now to carry the nursery process a step further and graft these stocks over in the spring with a variety such as quoted, that, besides being of good quality and cropping, averages 90 per cent. clean nuts in a season when walnut-blight is epidemic. There would be the further advantage of having an even sample at all times, which is indispensable in maintaining a business connection. Every large grove has a tree or two of outstanding merit. These should be marked and studied by comparison with other such trees in the locality. Along these lines considerable progress can

be made, as in other countries where walnut-culture is an industry of any importance.

Planters should note that a fully grown walnut-tree will cover a circle 40 ft. to 60 ft. across, and to obtain the maximum cropping-surface the trees must not touch, as branches that are shaded by interlocking remain barren. In the drier districts trees grafted with a variety proved in the locality can be recommended for planting on

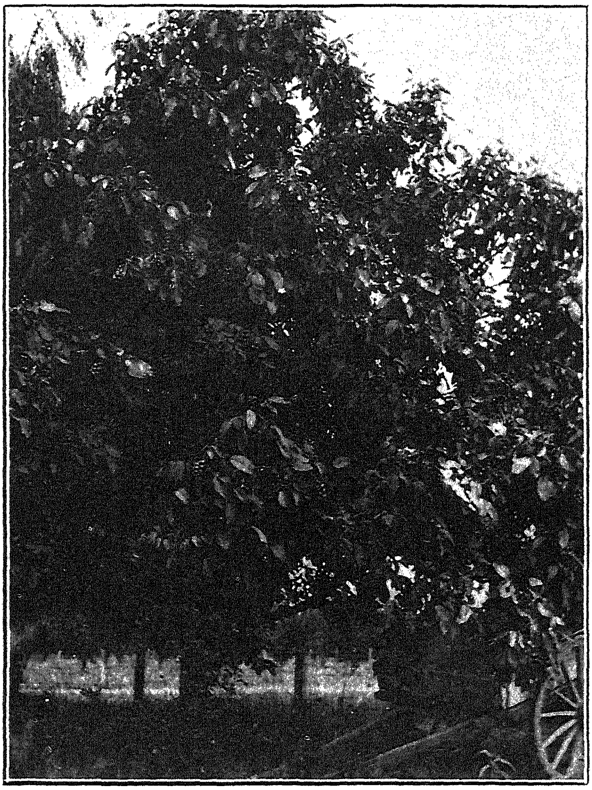


FIG. 5. AN OUTSTANDING WALNUT-TREE AT S. A. JARVIS'S ORCHARD, TWYFORD, HASTINGS.

Of one hundred or so walnut-trees planted round the orchard seventeen years ago, two are outstanding for constitution and cropping, one being the tree here shown.

good alluvial land, either on the margin of the leeward side of an orchard or garden, or as an avenue, for which the walnut is very suitable. The trees should be staked and the land cultivated, at least until the trees come into bearing; where planted in blocks, inter-cropping is usually carried on until that stage is reached. For the purposes of standard grading, which is so helpful in the marketing of a crop, it is desirable to confine the planting in any one locality to as few varieties as possible.

NEW ZEALAND AGRICULTURE.

ITS TREND IN THE PAST QUARTER-CENTURY.

In his presidential address to the Agriculture Section of the New Zealand Institute Science Congress held at Dunedin last month, Mr. A. H. Cockayne, Director of the Fields Division, Department of Agriculture, discussed the trend of agriculture in New Zealand since the year 1900. Following is the main part of his remarks on this subject :—

The area from which agricultural production takes place in New Zealand can be roughly divided into three main groups—the tussock grassland, the sown grassland, and the annually cropped land. In 1900 there were about 15,000,000 acres of tussock grassland, nearly 11,000,000 acres of sown grassland, and a little over 1,500,000 acres of annually sown crops. In 1925 tussock grassland remained between 14,000,000 and 15,000,000 acres, sown grassland had increased by 6,000,000 to nearly 17,000,000 acres, and annually sown crops were a little under 1,500,000 acres. It is therefore the 6,000,000 acres increase in sown grassland—of which the North Island claims 5,000,000 and the South Island 1,000,000 acres—that marks an essential feature of the development of New Zealand agriculture during the past twenty-five years. In the South Island the 1,000,000-acre increase has been derived partly from lowland tussock grassland, partly from forest, and partly from land previously under short-rotation cropping. In the North Island the major portion of the 5,000,000-acre increase has been from forest, and partly from the reclamation of swamp lands. The average annual rate of increase—about 270,000 acres—is rapidly shrinking, however, and the time when from 300,000 to 400,000 acres of grassland might yearly be added by axe and match has now gone by. The bush-burns of the future will be more in the nature of recovering grassland already sown, where nature is reasserting itself, than in displacing virgin forests with pasture.

There still remain, however, three great areas from which to draw our future increase in sown grasslands. These are much of the lowland tussock country, the pumice plains, and the heath-covered gum lands of the North. The last two will in the next twenty-five years add a large annual quota to the sown pasture of New Zealand; but in the past, while good forest country was available that could be cheaply grassed without the intervention of the plough, these great potential sources of grassland increase have been largely neglected. The work of the Department of Agriculture at Puwera has shown that on the gum lands of the North alone an increase of a quarter-million cows is quite reasonably to be expected. Without doubt, however, the future is concerned very largely with improvement both in the productive capacity and the utilization of the area already in grass.

During the period under review the development of dominance of danthonia and agrostis species over very wide areas not originally sown with these grasses, and the consequent problems involved in the management of both these types of induced vegetation units, is the most noteworthy grassland ecological feature so far as acreage involved

is concerned. Again, the development of paspalum as a major dominant over large areas in the North is one of the outstanding features.

In 1900 perennial rye-grass was the dominant seed sown under all conditions of soil and climate; but at the present time, with the exception of especially fertile soil and where a short-rotation pasture is intercalated between the growing of a series of annual crops, the tendency has been to reduce the amount sown. The first great change with which I was closely associated was the effort to make cocksfoot the dominant element on land which was below a permanent rye-grass standard. This has not been wholly successful, and an earlier knowledge of the ecological requirements of this grass would have saved much heartburning on the part of many farmers.

Paspalum, Western Wolths rye-grass, Lotus major, and Lotus hispidus can be ranked as the main new pasture species that have secured a permanent position, while subterranean clover is on the eve of winning a similar place. Crested dogstail, comparatively rarely used in 1900, is now general in the North Island, and amounts such as 3 lb. to 4 lb. in mixtures for hill country are now employed. The fall of Chewings fescue as the invariable subdominant in poor land sowings, except where seed-production is aimed at, is also one of the features of the period. The use of Italian rye-grass, both in short- and long-duration leas, has increased.

Of recent years the recognition that imported white clover is temporary and colonial white clover tends to be permanent, also the realization that unless by cultivation, manuring, or other process poor land can be raised to the fertility demanded by rye-grass, cocksfoot, or crested dogstail, dominance by a third-class grass, such as brown-top or danthonia, must be aimed at, have been salient features in grassland establishment.

During the period many pasture plants have been tried and found wanting. Among these Phalaris bulbosa, teff-grass, awnless brome, tall oat-grass, and prairie-grass are perhaps the most significant. For a period the "deep-rooted" system of Elliott threatened to influence pasture methods in New Zealand, and had it not been for the fact that tall fescue (of unenviable fame in this country) ranked as important in his sowings the system would have enjoyed great temporary repute. Even now chicory and sheep's burnet are found in some of our pastures, relics of the vogue that set in for a while.

Immense problems confront the investigator before the standardization of methods of grass-farming can be attained. Until quite recently the dominance of grassland was largely viewed as representing only a temporary phase in our agricultural development, to be completely modified before long by the introduction of more intensive methods of soil utilization in which the annually sown live-stock feeding crop would steadily increase in importance. In actual practice such has not been the case, and the factor of top-dressing grassland is definitely swinging the pendulum of agricultural practice along the line of less reliance being placed on annual crops, and increased reliance on methods of pasture manipulation and pasture management.

The basic feature of grassland from the management standpoint is the fact that its production is seasonal, rising to great heights during

portion of the summer and falling away at other periods. In other words, the seasonal stocking capacity of grassland varies enormously. Grassland stocked on the basis of its low-production period means an enormous wastage of feed during the high-production period, and the art of grass-farming consists of the maximum economic utilization of the whole of the feed produced. There are four great methods whereby this can be carried out, or attempted to be carried out. They are: (1) Buying stock when feed is plentiful, and selling when feed is scarce; (2) varying the feed requirements by a maximum employment of female animals; (3) overstocking when feed is scarce, relying on rebuilding up weight when feed is plentiful; (4) providing ample supplementary feed, either farm-grown or purchased, to fill in the low-production periods of grassland.

The first method appears wholly bad, but is still regularly made use of by the grass-farmer.

The second method is the most significant one that has been developed during the past twenty-five years. The winter stocking, excluding horses and pigs, at the present time is somewhere about 40,000,000 units*; but the summer stocking, using the same units and their offspring, is nearer the equivalent of 60,000,000 units. In 1900 there were 9,000,000 breeding-ewes, now there are 13,000,000; while the number of sheep wintered is not more than 5,000,000 above that of 1900. Since that date 1,000,000 cows have been added to our dairy herds, and the system of a short lactation period results in a high grass-utilization, corresponding with the period of maximum grass-production. Both the development of our dairy industry and our frozen-meat industry is based on varying the feed requirement to coincide with the rise and fall in grass-production. The exploitation of the maternity of live-stock is, in my mind, the outstanding feature of our progress—if it can be termed progress—of the past quarter-century.

The third method, of overstocking and allowing losses in weight, has many followers; but they are not prepared to admit that it is their intentional practice. It frequently leads to an apparently satisfactory result, unless overdone by automatically lessening summer grass-production, resulting in a spurious high utilization of the feed produced.

The fourth method, of supplying abundant supplementary feed, has been constantly reiterated by the farming community; but let us see what has actually happened. In the first place, however, it is necessary to point out that North Island farming and South Island farming are essentially different from the supplementary feed point of view. In 1900, 1 acre of supplementary feed was grown to every 23 stock units in Canterbury, Otago, and Southland; in the North Island 1 acre to every 110 stock units. To-day 1 acre is grown to every 25 units in those South Island provinces named, and 1 acre to 150 units in the North Island. The acreage certainly has increased, but not in proportion either to the added grass acreage or the increase in stock. In 1900 there were about 25,000,000 stock units; to-day there are over 40,000,000, and the carrying-capacity has increased from 1·6 stock units per acre of sown grass to 2 stock units per acre, an increase of

* The term "stock unit" as here used is based on sheep. One cattle-beast is reckoned as equivalent to five sheep.

25 per cent. in carrying-capacity, with a reduction in the number of acres of supplementary crop grown per 100 acres of grassland. The question that naturally arises is whether this tendency is a sound one economically, and it cries aloud for extensive and critical examination of farm-management practices throughout New Zealand. There is, in fact, no more pressing and urgent agricultural research work needed than that which comes within the scope of farm economics, and this is the very type of work that has been avoided in the past. It is freely admitted that all agricultural research work is of permanent benefit to our primary industries; but to me it would appear that proper farm economic studies are of such pressing national importance that their consummation cannot be safely neglected any further in our agricultural history. Fundamental as they are to a realization of sound land-values and rational development of any agricultural credit schemes, they demand our earnest attention.

So far as annually cultivated crops are concerned, the period under review has marked a steady decline in the production of those cash crops coming under the cereal group. Whereas in 1900 our cereal exports exceeded in value those of dairy-produce, to-day we do not supply our local requirements in cereals, and the dairy export figures have risen from less than £1,000,000 to nearly £20,000,000. The fall in cereal-production has been most pronounced with regard to oats, the lessened production being accompanied by a lessened demand. For wheat, on the contrary, the demand has increased, but production is steadily diminishing, and there is a widespread feeling that the acreage will continue to decline. The standardization of Solid-straw Tuscan as the dominant wheat in New Zealand, the work of Dr. Hilgendorf at Lincoln in pure-race selection, the rise of Algerian oats within the range of severe crown-rust infestation, and the use of the term " Gartons " for all white oats of the grain-producing types are outstanding features in our cereal history of the period.

In supplementary crops, turnips and rape still, as in 1900, dominate the position so far as acreage is concerned, but disease and insect pests have in many districts become serious limiting factors in the successful production of these two crops. This is leading to an increase in such crops as chou moellier, and has particularly influenced the acreage devoted to green oats. The most outstanding feature has been the capture of the turnip and root-crop seed trade generally by the high-priced packet in place of the open market seed of the past. Mangolds and carrots bid fair to increase in acreage, but it is only in certain districts that such is really noticeable. One of the most outstanding of the new crops is Japanese millet, which owes its rapidly attained popularity almost entirely to the fact that it can be managed in exactly the same way as young grass. In the fodder-crop group the extension of Italian and Western Wolths rye-grass for milk-production in ewes is noticeable.

One of the most outstanding features of the period under review is the increase in the use of artificial manures. In 1900, with an annual crop acreage of a little more than at present, somewhere about 25,000 tons of artificial manures—apart from freezing-works material—were used each year, half of this being bonedust. Almost the whole of this material was used on annual crops. To-day over 200,000 tons of

artificials are used, of which more than two-thirds are for top-dressing grass land. Approximately half the manure used is superphosphate, with basic slag second on the list, closely followed by ground rock phosphate, generally in combination with a more soluble form. The area of grass-land now being top-dressed each year just exceeds 1,000,000 acres, or just on 5 per cent. of the sown grassland. The increasing of this proportion, to my mind, represents the great advance that will be made in the next decade, when the acreage annually dealt with should be at least trebled.

With the advance in the use of artificial manures but little progress has been made in exact knowledge as regards the comparative efficiency of individual fertilizers. Our knowledge of the economic value of potash and nitrogen remains much as it was in 1900. Both are often used in combination with phosphates, but whether they are worth while is still highly problematical. In this connection the field-trial work of the Department of Agriculture should finally yield definite and reliable results.

During the whole of the period under review the advantages of liming have been reiterated by all connected with the land. The annual quantity used exceeds 100,000 tons, almost wholly crushed limestone. Remarkable to relate, even when facilities are available it is only in certain districts that liming is an important feature. Over 60,000 tons of the total are used in Southland. The great majority of soil analyses show lime deficiency. Lime has been tried intermittently over the whole of New Zealand by farmers, but the practice has stabilized only in certain districts.

THE BETTER-FARMING TRAIN IN VICTORIA.

MR. J. W. DEEM, Instructor in Agriculture, who recently visited Australia, supplies the following note on this activity of the Victorian Department of Agriculture :—

The train consists of from ten to twelve carriages and trucks painted yellow and labelled in big letters "Better-farming Train." The carriages are fitted up to contain exhibits and models of the various branches of agriculture. One, for example, is devoted to fruit-spraying machinery, grading models, &c. ; another to farm crops, grain exhibits from manurial trials, models of silos, &c. ; while others contain farm live-stock. In addition to agricultural exhibits there is a carriage fitted up for a mothercraft and infant-welfare nurse, and another for home economics. The live-stock are usually borrowed from private owners, and an endeavour is made to get animals with a reputation for butterfat-production or show-ring success. In the case of dairy cows in milk, the owner usually accompanies the train.

Various experts of the Agriculture Department, &c., accompany the train and give lectures and advice. The nurse and lecturer on home economics remain in their carriage, but the agricultural officers lecture on the platform, or in the goods-shed if the day is wet or cold. The train usually pulls up at a station in the forenoon, remains until 8 or 9 o'clock at night, and then moves on to the next centre. The agricultural lectures are short, averaging about twenty minutes. No questions are allowed, but when the lecturer has finished he goes back to his exhibit on the train, where farmers may meet him and ask questions or discuss any matter connected with his branch of agriculture. One of the carriages is fitted up for lantern lectures in the evening. The train is really a travelling agricultural exhibit with lecturers in attendance, and must serve as a good introduction between agricultural officers and farmers.

TESTING OF NEW-ZEALAND-GROWN WHEATS.

RESULTS FOR YEAR 1925.

(Concluded.)

L. D. FOSTER, B.Sc., Analyst, Chemistry Section, Wellington.

IV. QUALITY OF FLOURS.

IT would be out of place to give in the *Journal* more than a very brief outline of the chemical methods of judging the strength of flours; the following brief survey and the results obtained from some flours milled in 1925 from New-Zealand-grown wheats may indicate, however, the importance of certain lines of progress. These results are additional to the general routine analyses and baking tests of flours given in Parts II and III of this series, published in the *Journal* for December, 1925, and January, 1926, respectively.

The factors controlling in varying degree the strength (or quality) of flours are now considered to be: (1) The *quantity* of the gluten present in the flour; (2) the *quality* of the gluten present in the flour; (3) the "active" acidity, or hydrogen-ion concentration, of the flour; (4) the enzyme activity of the flour. Without at present going into any detailed descriptions it is best for the sake of clearness to enumerate these factors now and to refer to them later in greater detail.

In Parts II and III the connection between quantity of gluten (or protein) and baking-value has been discussed. The *quality* of gluten is, however, a more difficult factor to measure. Gluten of good quality is supposed to be creamy in colour, elastic, and cohesive, and is judged accordingly; poor gluten is greyish, sticky, and lacking in cohesion. A description of a visual inspection of different glutens was included in Part II. This is one of the oldest methods of judging strength, and though it has been completely condemned in certain quarters (4) there is no doubt that at times it is of considerable use.

(a.) HYDRATION CAPACITY OF GLUTEN.

Purely chemical methods of determining the quality of gluten have not proved satisfactory, but physico-chemical methods are at present attracting considerable attention. Amongst these latter are methods due largely to Sharp and Gortner (3) in the United States, and to Luers and Ostwald (6) in Europe, who have found a relationship between the viscosity of flour-in-water suspensions and baking properties. These results indicate that flour-strength is connected with the colloidal properties of the gluten. A consideration of the colloidal state is too large a subject for these pages, and the properties of colloids cannot be suitably outlined in the *Journal*; it will suffice to say that gluten exists in the dough in the colloidal state. It must be added, however, that very recently Blish and Sandstedt (1) have said that they found no practical connection between viscosity and baking-value; and that Luers (6) applied these determinations only to flours obtained

from wheats grown in the same locality. It may be stated here that these last two papers came to hand after the results given in this paper had been completed.

Viscosity determinations require the use of special apparatus, but Gortner and Doherty (4) have shown that viscosity is intimately connected with the degree to which a gluten will take up water under certain conditions. This power of taking up water varies with glutens of different quality; a good gluten is said to take up a large quantity, a poor gluten a smaller quantity of water. The amount of water thus taken up under certain definite conditions is called the "hydration capacity," or degree of imbibition, of the gluten.

The method followed with the New-Zealand-grown flours was that described by Gortner and Doherty (4). The results were calculated as the number of grams of water taken up by 100 grams of wet gluten standing in N/50 hydrochloric acid for fifty minutes; the results are therefore expressed as percentages. A varying degree of success was obtained, though undoubtedly this method gives, with certain notable exceptions, some indication of strength; on an average, perhaps, the stronger flours examined contained glutens with hydration capacities higher than the weaker flours.

The following table divides the different varieties into two series, one showing samples with a hydration capacity above 50 per cent. and the other those below 50 per cent.:—

Table 7.—Samples with Hydration Capacities of more and less than 50 per Cent.

Above 50 per Cent.			Below 50 per Cent.		
Sample No.	Variety.	Hydration Capacity.	Sample No.	Variety.	Hydration Capacity.
S 773	Velvet Ngapara ..	76	S 776	Zealand ..	49
S 769	Marquis.. ..	75	S 708	Tuscan	48
S 777	Red Fife ..	60	T 78	Durum	48
S 711	Tuscan	60	S 710	Tuscan	44
T 50	Marquis.. ..	59	S 771	Velvet	43
T 37	Velvet	58	S 767	Queen Fair ..	43
T 75	College Hunter's ..	55	S 709	Tuscan	42
T 56	Solid-straw Tuscan	55	S 712	Tuscan	40
S 775	Yeoman ..	53	S 774	Essex Conqueror ..	39
S 714	Velvet	53	S 768	Major	39
S 765	Jumbuck ..	52	T 101	Hybrid W ..	39
S 766	Queen Fan ..	51	T 76	Velvet	37
T 51	Major	51	S 778	Hybrid W ..	32
T 77	Solid-straw Tuscan	51	S 779	Scandinavian ..	14
			S 772	Snowdrop ..	10

Undoubtedly there is in Table 7 a fairly complete division between those varieties generally considered to be strong wheats, and weaker varieties. For instance, the strong wheats Velvet, Marquis, Red Fife, and Yeoman are all found in the first column. The varieties from Gore—T 50, 51, and 52—which possessed better baking properties than their protein content indicated, but which contained gluten of

average quality as determined by visual inspection, are also classed among the stronger samples. At the same time it must be pointed out that most of the samples from Lake County, which also possessed better baking properties than their protein content indicated, but which possessed gluten of *good* quality when judged by appearance, are included among the weaker varieties. Moreover, several samples with very low hydration capacities produced quite good loaves from the point of view of volume. These samples were Essex Conqueror (S 774), Scandinavian (S 779), and Snowdrop (S 772). (See column 7, Table 9.) In this series of wheat-flours, therefore, the hydration capacity was not related to any marked extent with the loaf-volume. One must remember, however, that only glutens containing the same amount of water—that is, samples with the same wet to dry gluten ratio—can be fairly compared. It is true, too, that it would be fairer to compare only the wheats grown in the same districts and corresponding approximately in protein content; but even when the Ashburton Experimental Farm wheats are considered we find that Scandinavian, with a hydration capacity of only 14 per cent., made a better-sized loaf than Yeoman with 75 per cent. These two samples each contained 13·75 per cent. protein, so may fairly be compared. Some other factor than hydration capacity is obviously concerned here with baking-value.

A closer relationship, however, was found between the texture of the loaf and degree of hydration of the gluten. The following table consists of samples with fairly high and fairly low degrees of hydration, together with a description of the texture of the loaves made from them :—

Table 8.—Connection between Hydration Capacity of Gluten and Texture of Loaf.

Better Texture.				Poorer Texture.			
Sample No.	Variety.	Degree of Hydration.	Texture.	Sample No.	Variety.	Degree of Hydration.	Texture.
S 773	Velvet Ngapara	76	Good.	S 768	Major ..	39	Good.
769	Marquis ..	75	Good.	774	Essex Conqueror	39	Fair.
777	Red Fife ..	60	Very good.	T 101	Hybrid W ..	39	Medium.
711	Tuscan ..	60	Good.	76	Velvet ..	37	Medium.
T 50	Marquis ..	59	Good.	S 778	Hybrid W ..	32	Good.
37	Velvet ..	58	Good.	392	Durum ..	26	Fair.
75	College Hunter's	55	Good.	779	Scandinavian ..	14	Poor.
52	Solid-straw Tuscan	52	Medium.	772	Snowdrop ..	10	Medium.

A fairly complete separation may be made here — a separation which is very consistent considering the difficulty in some cases of arriving at even an approximate measure of texture. Finally, with regard to the foregoing method of determining strength, it may be said that the hydration capacity of the New Zealand wheats tested in 1925 was only moderately connected with loaf-volume, but was more closely connected with loaf-texture.

(*b*.) "ACTIVE" ACIDITY OF DOUGHS, OR pH VALUE.

It is an old and often quoted fact that sour milk mixed in the dough sometimes improves the baking-qualities of a flour. This improvement is probably brought about by the increased "active" acidity of the dough, due to the presence of the lactic acid in the sour milk.

Active acidity is quite a distinct term from *total* acidity; two acids of the same strength (*i.e.*, of the same total acidity) may differ quite considerably in their active acidity. If we take equivalent solutions of, say, hydrochloric acid and lactic acid (the acid present in sour milk), the former tastes more sour than the latter. The reason for this is briefly as follows: Acids are said to tend to throw off hydrogen ions;* strong acids show this tendency to a marked degree, weak acids to a much more limited extent. As only the hydrogen ions taste sour, a solution of hydrochloric acid (which is a strong acid and throws off hydrogen ions to a marked degree) therefore tastes very sour. Lactic acid (a weak acid) throws off ions to only a limited extent, and tastes only slightly sour. Even though lactic acid is a comparatively weak acid, it is well to remember that it is nevertheless capable of producing, under certain conditions, a small but important number of these hydrogen ions.

To this concentration of hydrogen ions—that is, to the number of hydrogen ions thrown off—the "active" acidity of any acid is due. The concentration of hydrogen ions is therefore the correct term to use, though "active" acidity, as distinct from "total" acidity, expresses the same idea quite clearly.

It has been found expedient to use a system of stating the concentration of hydrogen ions which at first sight may appear confusing. Without going into details, the system is briefly this: The concentration of hydrogen ions is denoted by the symbol pH, in numbers from 1 to 14. The exactly neutral point is denoted by pH 7·0; the *lower* the number is, the *more* acid is the solution; the higher it is, the more alkaline is the solution.

ENZYMES AND ENZYME ACTIVITY.

The hydrogen-ion concentration of doughs is, among other things, important because of its effect on the enzymes of the flour and yeast. Enzymes are complicated compounds, present in living organisms, and capable, under ordinary conditions of temperature and moderate concentrations of acid or alkali, of bringing about many chemical reactions.

One of these enzymes is diastase, which is capable of converting the starch present in flour into a sugar. The reaction begins when, in making the dough, water is added to the flour and the whole is

* It is supposed that when certain substances (*e.g.*, acids, bases, and salts) are dissolved in water they split up completely in dilute solution, and to a less extent in more concentrated solution (as, for instance, in a dough mixture) into two kinds of particles with equal but opposite charges of electricity. These electrically charged particles are called "ions." To take some simple cases: Hydrochloric acid (HCl) in dilute solution in water breaks up into ions of hydrogen (H) which carry positive (+) charges, and an equal number of chlorine (Cl) ions carrying negative (−) charges of electricity. Common salt (NaCl) breaks up into positive sodium (Na) ions and negative chlorine (Cl) ions.

maintained at a suitable temperature. The yeast present in the dough contains other enzymes which convert this sugar, and also the sugar present in small quantities in the original flour, finally into carbon dioxide (CO_2) and alcohol. Most of the alcohol escapes, but the carbon dioxide is to a large extent retained in the dough, forming small bubbles in the gluten and making the dough rise and so assume the shape of the loaf. The evolution of adequate amounts of carbon dioxide, which is dependent on vigorous enzyme activity, is therefore essential for the efficient fermenting and proving of the dough.

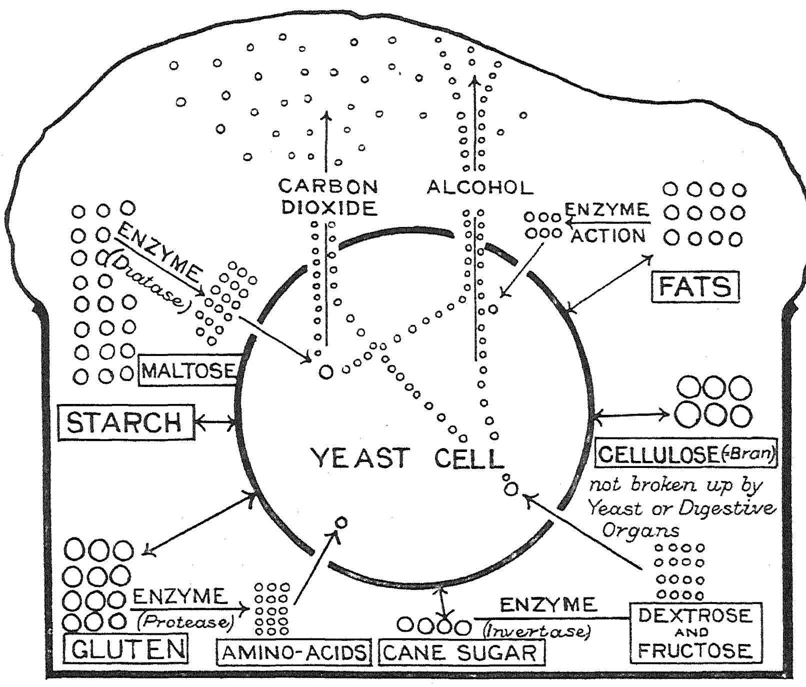


FIG. 10. DIAGRAMMATIC REPRESENTATION OF THE ACTIVITIES OF ENZYMES IN BREADMAKING.

The method by which the nutrition of the yeast cell is maintained, and the complex series of changes which take place, are indicated. Reversed arrows are intended to show that the yeast cell cannot act directly upon the molecules of these dough constituents, but that the latter must be first broken down by other enzymes into simpler molecules.

[*Adapted from diagram in "Die Theorie der praktischen Brot und Mehlbereitung." A. Fornet.*

There are said to be fourteen different enzymes in yeast, but only four are of any considerable importance—namely, invertase, maltase zymase, and protease. Flour contains (among others) diastase and protease. Malt-extracts which are sometimes added to flours contain a considerable amount of diastase, as well as a certain amount of protease.

Fig. 10, which is adapted from an ingenious drawing by Fornet (2), shows diagrammatically the changes which are brought about by

enzyme activity during breadmaking, and the means by which the all-important nutrition of the yeast cell is maintained.

PRODUCTION OF CARBON DIOXIDE.

For the production of a good loaf a sufficient volume of carbon dioxide must obviously be produced. This depends in turn upon the activity of the different enzymes present in the dough, for the more active they are the greater will be the production of gas necessary to make the dough rise. Two sets of conditions—though there may be others—favour maximum enzyme activity. One of these is temperature, and for this reason dough is kept moderately warm during proving; yeast is most reactive at 26·7° C., though a temperature of 32°–35° C. (90°–95° F.) is maintained in the bakehouse. The other condition necessary for maximum activity is a suitable concentration of hydrogen ions. For instance, the enzyme diastase present in malt preparations used for improving flour-strength is *twice* as active at pH 5·0 as at pH 6·0.

pH OF FLOUR AND DOUGH AND DEGREE OF BUFFERING.*

Flour itself has a value of pH 6·0, more or less, but it has been found that for breadmaking the best concentration of hydrogen ions in the dough is about pH 5·0. Such an increase in active acidity occurs during fermentation; a flour of good baking-value approaches this value more nearly than a poorer flour. The conditions present in poor flours are such that perhaps they are not able to attain this optimum degree of active acidity at all, or, if they do attain it, only very slowly. These poorer flours are for some reason resistant to any change in active acidity—that is, from pH 6·0 to 5·0. The power of resistance to such change is known as the degree of "buffering" of the dough. The relative degree of buffering can be measured, and should give some idea of the ease with which the dough attains the hydrogen-ion concentration necessary for maximum enzyme activity and therefore for the production of a good loaf. In column 12 of Table 9 the relative degree of buffering of the flours examined in 1925 is given. It should be explained here that the higher the degree of buffering the *lower* will be the figure in column 12—that is, the less easily will any change in active acidity be brought about, or the less easily will such a flour attain the requisite pH for the best results in baking. Unless this is clearly realized the figures will only prove confusing. Average flours show a figure of 1·0–1·1; better flours show values from 1·2–1·4; poorer flours, values from 0·9 down to 0·5.

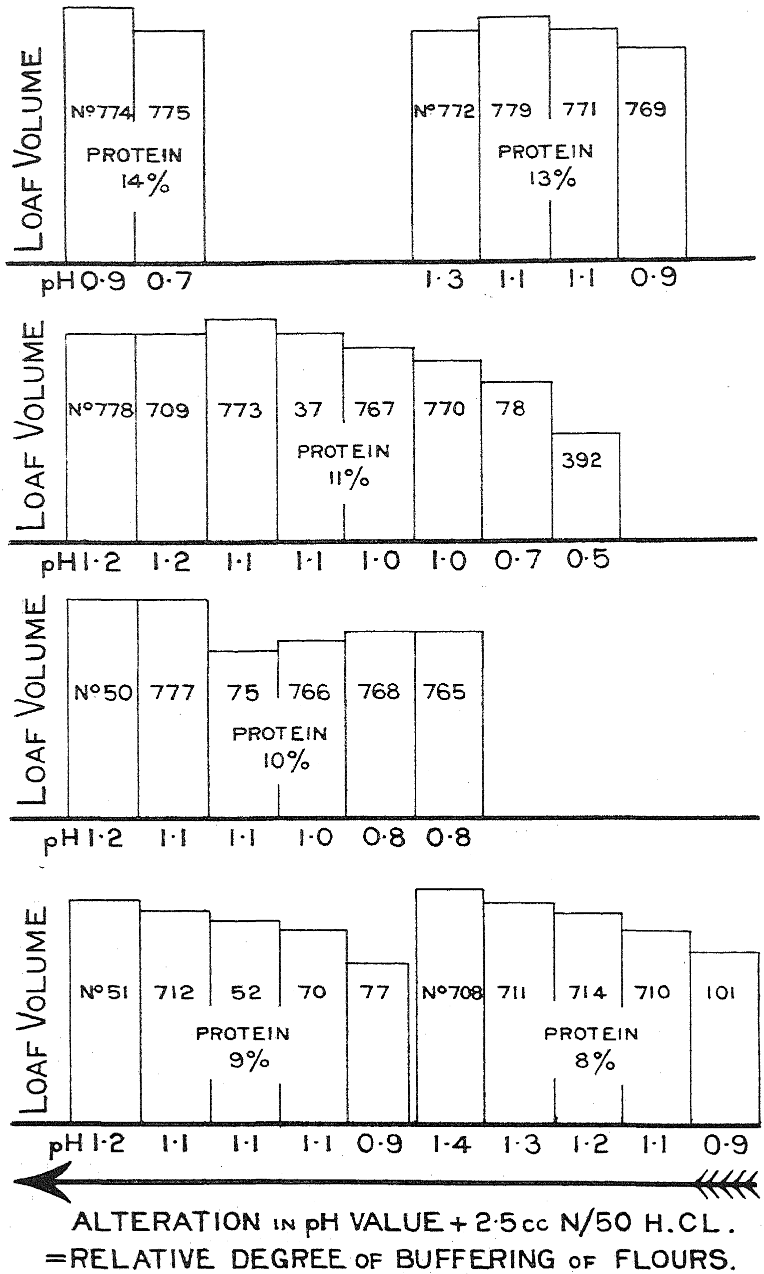
The method of determining the pH value of these flours was the colorimetric one. Forty grams of flour were mixed with 100 grams of distilled water and digested for one hour at 25° C. The suspension was filtered, as it was found that the filtered extract gave the same

* Buffer action: If one were to add a drop of hydrochloric acid to a quart of water the resulting solution would have a well-marked active acidity, as the hydrochloric acid would break up almost completely into hydrogen and chlorine ions. If, on the other hand, one were first to add certain substances (such as phosphates or proteins, both present in flour) to the water, and then to add the drop of hydrochloric acid, the resulting change in active acidity (pH) would be hardly appreciable. This action of certain substances (like phosphates and proteins) to resist any change in active acidity is called a "buffer" action.

Table 9.—Hydration Capacity, pH of Flour, and Degree of Buffering, &c.

1 Sample No.	2 Variety.	3 Locality.	4 County.	5 Approx. Protein Content.	6 Protein.	7 Loaf-volume.	8 Ratio, Wet to Dry Gluten.	9 Hydration Capacity.	10 pH Flour.	11 pH Flour + 2·5 c.c. N/50 Acid.	12 Relative Degree of Buffering.*
				Per Cent.	Per Cent.	C.C.		Per Cent.			
S 774	Essex Conqueror ..	Ashburton ..	Ashburton ..	14	14·69	755	3·26 : 1	39	6·0	5·1	0·9
S 775	Yeoman ..	,, ..	,, ..		14·19	700	3·29 : 1	53	5·9	5·2	0·7
S 772	Snowdrop ..	,, ..	,, ..		13·50	700	3·32 : 1	10	5·9	4·6	1·3
S 779	Scandinavian ..	,, ..	,, ..	13	13·75	720	3·25 : 1	14	5·9	4·8	1·1
S 771	Velvet	,, ..	,, ..		13·56	700	3·39 : 1	43	6·0	4·9	1·1
S 769	Marquis.. ..	,, ..	,, ..		13·75	660	3·08 : 1	75	5·9	5·0	0·9
S 778	Hybrid W ..	,, ..	,, ..		11·88	660	3·17 : 1	32	5·9	4·7	1·2
S 709	Tuscan	Arrowtown	Lake ..		11·75	660	2·94 : 1	42	5·8	4·6	1·2
S 773	Velvet Ngapara ..	Ashburton ..	Ashburton ..		11·88	670	3·12 : 1	76	5·9	4·8	1·1
T 37	Velvet	Lincoln ..	Springs ..		11·13	650	3·25 : 1	58	5·9	4·8	1·1
S 767	Queen Fair ..	Ashburton ..	Ashburton ..	11	11·31	640	3·28 : 1	43	6·0	5·0	1·0
S 776	Zealand.. ..	,, ..	,, ..		11·63	590	2·98 : 1	49	5·9	4·9	1·0
T 78	Durum	Hinds ..	,, ..		11·81	540	3·12 : 1	48	6·0	5·3	0·7
S 392	,, ...	..	..		11·81	440	2·80 : 1	26	5·9	5·4	0·5
T 50	Marquis.. ..	Gore ..	Southland ..		10·88	680	2·93 : 1	59	5·9	4·7	1·2
S 777	Red Fife ..	Ashburton ..	Ashburton ..		10·56	680	2·76 : 1	60	5·9	4·8	1·1
T 75	College Hunter's ..	,, ..	,, ..	10	10·31	560	3·07 : 1	55	5·9	4·8	1·1
S 766	Queen Fan ..	,, ..	,, ..		10·31	570	2·72 : 1	51	6·0	5·0	1·0
S 768	Major	,, ..	,, ..		10·75	600	3·28 : 1	39	5·9	5·1	0·8
S 765	Jumbuck ..	,, ..	,, ..		10·69	600	3·08 : 1	52	5·9	5·1	0·8
T 51	Major	Gore ..	Southland ..		9·63	680	3·13 : 1	50	6·0	4·8	1·2
S 712	Tuscan	Gibbston ..	Lake ..		9·38	660	2·86 : 1	40	5·9	4·8	1·1
T 52	Solid-straw Tuscan	Gore ..	Southland ..	9	9·44	640	3·20 : 1	55	5·9	4·8	1·1
T 76	Velvet	Ashburton ..	Ashburton ..		9·25	630	3·19 : 1	37	6·0	4·9	1·1
T 77	Solid-straw Tuscan	,, ..	,, ..		9·69	535	2·99 : 1	51	5·9	5·0	0·9
S 708	Tuscan	Gibbston ..	Lake ..		8·69	700	2·69 : 1	48	5·9	4·5	1·4
S 711	,, ...	Arrowtown	,, ..		8·56	670	2·89 : 1	60	5·9	4·6	1·3
S 714	Velvet	Ardgour ..	Vincent ..	8	7·19	650	2·76 : 1	53	5·9	4·7	1·2
S 710	Tuscan	Miller's Flat	Lake ..		8·50	620	2·96 : 1	44	6·0	4·9	1·1
T 101	Hybrid W ..	Horrelville	Eyre ..		8·75	580	3·04 : 1	39	5·9	5·0	0·9

* = Change in pH of 25 c.c. of flour suspension + 2·5 c.c. N/50 hydrochloric acid.



GRAPH 4.

Showing the connection, in flours of approximately the same protein content, between the degree of buffering of the flours and the volumes of the loaves obtained from them. The less the flour is buffered, the greater is its tendency (among the samples investigated) to form a loaf of good volume. The arrow emphasizes the *increase* in loaf-volume with decrease in relative degree of buffering of flours.

value as a suspension cleared centrifugally. The pH value of the clear extract was taken as the pH of the flour. For ascertaining the relative degree of buffering of the flour, 25 c.c. portions of the clear extract were treated with 2·5 c.c. and 5·0 c.c. of N/50 hydrochloric acid; these were then brought to a volume of 50·0 c.c. and their pH value determined. Only the figures obtained on the addition of 2·5 c.c. of acid are given in the table, as it was found that the order of change of the pH value was the same with 2·5 c.c. and 5·0 c.c. acid. The above method is practically that described by Rumsey (8).

In Table 9 the flours are arranged first of all in order of approximate protein content; some such division is necessary to eliminate the effect on loaf-volume of other factors such as protein content (see column 6). The flours are thus divided into six series, containing respectively 14 per cent. protein, 13 per cent., and so on. Each series is then arranged in order of the degree of buffering (column 12) of the different flours. It will be seen that there is a close correlation in each series between the degree of buffering and the loaf-volume. This is shown more clearly in Graph 4, which illustrates diagrammatically this close relationship. In each series, with very few exceptions, there is a decided decrease in loaf-volume from left to right, coinciding with an increase in degree of buffering.

These buffer figures also explain the failure of certain flours with a good protein content to make good loaves. Especially so is this the case with samples of Durum; S 392, which was very highly buffered, possessed very poor baking-qualities; and S 78, which also showed a high buffer value, was only a little better (Fig 11). In addition, these figures throw light on the flours of low protein content which produced good loaves. For instance, the samples from Lake County (Fig 12) were without exception lightly buffered; so were the samples from Gore (Fig. 13). These samples all gave better baking tests than their protein content indicated, as pointed out at the time in Part III (*Journal*, January, 1926). It will be noticed, too, that Lake and Southland varieties occupy prominent places in each series in Table 9—that is, in each series of flours containing about the same amount of protein.

In this series of tests the degree of buffering of the flours was undoubtedly closely connected with the volume of the loaf (column 7). A lightly buffered flour gave in general a loaf of good volume; a highly buffered flour gave one of poor volume. This factor appeared more important than protein content among such flours. Where the degree of buffering of the flours was an average value the protein content was a fair indication of strength. In Part III it was also said that Marquis (S 769), amongst the Ashburton samples, was perhaps not so good as its protein figure indicated (Fig. 14): this may be explained by its high degree of buffering. Scandinavian (S 779), Velvet (S 771), Snowdrop (S 772), and Red Fife (S 777) were described as better than would appear from their protein content (Fig. 14): these varieties were all buffered to a less extent than average samples.

The results obtained as a whole thus indicate that flours more lightly buffered than average samples will produce loaves of good volume, even though they may be low in protein content. The reverse is also true: highly buffered flours, even though they possess a high protein content, will produce poorer loaves than such protein content suggests.

TRACINGS OF EXPERIMENTAL LOAVES.

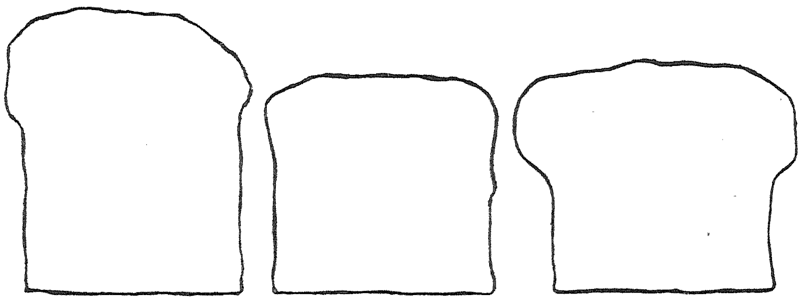


FIG. 11.

The two Durum wheat-flours failed to make good loaves; both were highly buffered samples. The check loaf was that one made from a sample of good average baker's flour and baked with each batch of loaves.

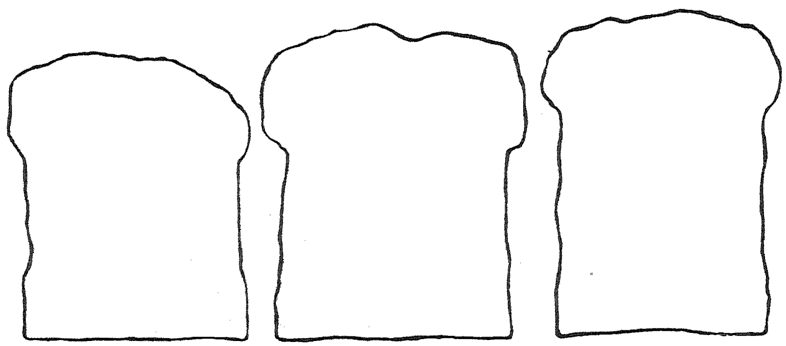


FIG. 12.

Samples S 768 and 711, both from Lake County, were low in protein content, but made loaves of very good volume. Both were lightly buffered.

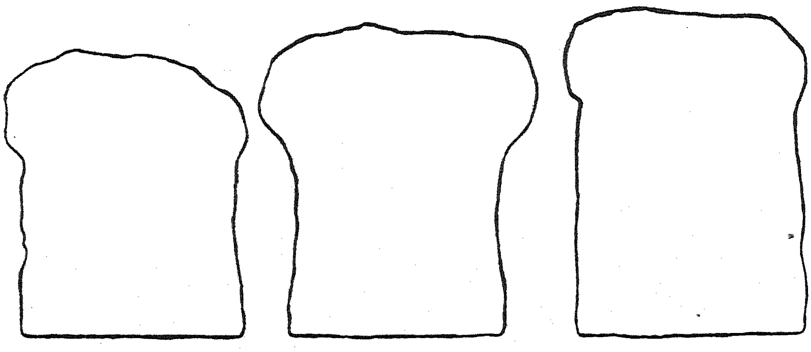


FIG. 13.

Showing the good volume of the two Southland samples. These were both lightly buffered.

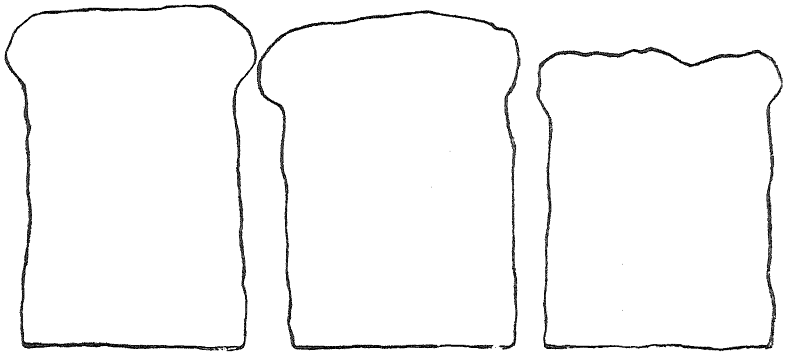


FIG. 14.

Baked from three Ashburton wheat-flours. These flours each contained approximately the same amount of protein, but Marquis (S 769), with the smallest loaf-volume, was the most highly buffered.

From theoretical considerations alone one would not expect the initial pH of the doughs of straight-grade flours such as these experimentally milled flours to have any close relationship with their baking-value, nor was any found in the flours investigated. The best criterion of baking-value, other things being equal, was the degree of buffering of the flour.

The percentages of ash are not given in the table, but only a slight correlation was found between ash, initial pH value of the flour, or degree of buffering. A slight but not very obvious correlation was found between degree of buffering and quality of flour as indicated by the hydration capacity of the moist gluten. No correlation could be found between percentage absorption of water and degree of buffering, or initial pH value of the flour.

SUMMARY.

(1.) The hydration capacity of the moist glutens of flours obtained in 1925 from thirty-two New-Zealand-grown varieties of wheats was not always an indication of the quality of the flours as revealed by baking tests. There was, however, a fairly close relationship between hydration capacity and texture of the loaves.

(2.) There was no relationship between quality of gluten as determined respectively by hydration capacity and by visual inspection of the gluten.

(3.) The initial pH of the flour was not connected with loaf-volume

(4.) The hydrogen-ion concentration of the dough in the later stages of fermentation must theoretically be of considerable importance. An idea of the relative ease with which optimum conditions of hydrogen-ion concentrations are attained in the dough should be gained from a determination of the degree of buffering of the flour. Among the flours examined it was found that in those of approximately the same protein content the degree of buffering was closely correlated with the loaf-volume. It was found, too, that a highly buffered flour, even though of high protein content, produced a loaf of poor volume ; and,

conversely, a lightly buffered flour, even though low in protein content (see Lake County and Southland samples), produced a loaf of good volume.

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WEEDS AND THEIR IDENTIFICATION.

(Continued.)

BATHURST BURR (*XANTHIUM SPINOSUM* L.).

ESMOND ATKINSON, Biological Laboratory, Wellington.

BATHURST burr has been a wild plant for a great many years in New Zealand; it was first recorded in 1864 as naturalized in the North, and appeared as far south as Wellington in 1877. Later it showed signs of spreading freely, particularly on the North Island east coast,* and from 1890 onwards there was a good deal of controversy on the question as to whether it was likely to prove as serious a menace as in Australia. The outcome of this was that the plant was included under the Noxious Weeds Act, 1900, in the schedule comprising those plants deemed to be noxious weeds when so declared by a local authority. Although it is definitely not a weed of the first rank in New Zealand, its Australian reputation means that we cannot afford to ignore it altogether. As, moreover, Bathurst burr is often confused with other quite different plants, it has been thought well to include it in this series of articles.

DESCRIPTION.

Bathurst burr (which is sometimes placed by botanists in the daisy and thistle family, and sometimes in a small, closely allied one) is an annual, 1 ft. to 3 ft. high, and bushy in habit owing to its freely branching stems. The stems are rather wiry, and are covered, particularly

* For further details see "The Naturalization of Animals and Plants in New Zealand," by G. M. Thomson.

in their upper and younger parts, with short hairs, which give them a greyish-white colour. The leaves are arranged first on one side of the stem and then on the other ("alternate"), 1 in. to 4 in. long, tapering more or less gradually at both ends, and those at the tops of the branches are roughly lance-shaped in outline, with a few small teeth or with none at all. Farther down on the stems this shape is lost sight of through the leaves being deeply and irregularly lobed—three-lobed in reality, with the middle one much the biggest, and often with a number of secondary ones as well. The upper surface of the leaf is green, but the midrib and veins above, and all *except* the midrib and veins below, are clothed in a greyish-white covering of hairs like that on the stems, only thicker. The leaves on the upper parts of the stems are almost stalkless, while the larger ones lower

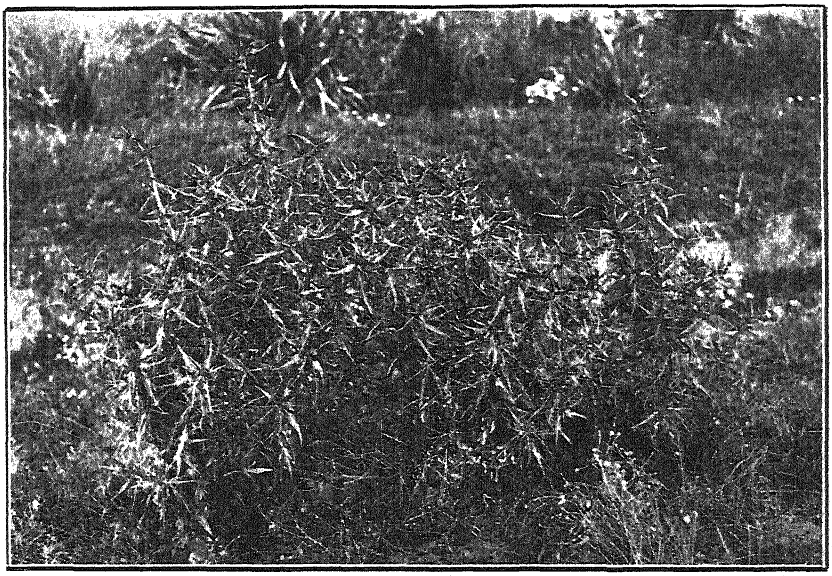

FIG. 1. BATHURST BURR, PHOTOGRAPHED NEAR WAIROA, HAWKE'S BAY.
[*Photo by W. D. Reid.*

down taper at their bases to stalks that may be as much as 1 in. in length. From the junction of leaf and stem ("axil") springs a very conspicuous three-pronged yellow spine—the middle prong longer than the others. Often these spines are in pairs at the axils. It is their presence that gives the plant its specific name *spinosum*, and makes it easy to identify at almost any stage in its life-history.

The flowers are in heads of two sorts, the male and female ones being borne separately. In the drawing (Fig. 2) two clusters of male flowers can be seen at the top of the branch, and no further description of these will be given, as they are not of much assistance in identifying the weed. The female head or "burr" is hard and bony in texture, about ½ in. long, cylindrical in shape, tapering to its connection with

FIG. 2. BATHURST BURR.

(*a*) Branch with burrs, natural size; (*b*) burr, showing hooked spines, magnified about three diameters.

[*Drawing by E. H. Atkinson.*

the branch at one end and to one or two short beaks at the other. It is pale yellow in colour, hairy on the surface, and is covered with dark-coloured spines tipped with yellow hooks. If a burr is cut across it will be found to contain two cells, each filled with an achene (so-called seed). These remain within the burr until it decays, and do not possess anything corresponding to the down of thistles.

DISTRIBUTION AND CONTROL.

Bathurst burr is a native of South America, but now occurs as an introduced plant in most warm countries. In New Zealand it is found chiefly in the warmer soils of the North Island, and is most abundant in Hawke's Bay. It has been reported as "rare" in Marlborough—the only South Island locality that the writer is aware of. It is often said of the plant that it is sporadic in its occurrence—that is, single individuals may be found scattered in widely separated localities. It would certainly be advisable to destroy any such plants that may be found. The bony character of the burrs is a fact already mentioned, and it may be repeated here, since it means that fruits may lie for a long time in the ground before their decay allows germination to take place, and might help to account for certain irregularities of occurrence of the plant.

Bathurst burr is not a serious weed of pasture, and cannot maintain itself where there is a good sole of grass. Experiments indicate that at certain stages the plants are poisonous to stock, which may also suffer mechanical injuries from the spines, but as a rule it is avoided by them. The real danger in allowing it to spread lies, of course, in the very great damage the burrs may do to wool. Enough evidence on this point is available from Australia to convince the most sceptical. As was pointed out in the leaflet on Bathurst burr issued many years ago (1900) by this Department, all efforts to stop the spread of a plant which depends for its distribution on the entangling of its very numerous hooked burrs in wool should be directed towards the prevention of the formation of such burrs, and the weed should be attacked in the flowering stages. In the *Monthly Bulletin of the Department of Agriculture, State of California*, spraying with a solution of copper sulphate (1 lb. to 10 gallons of water) is recommended as effective against young plants 6 in. to 1 ft. high.

The average cow requires 10 tons of grass or its equivalent to maintain itself during the year. Maintenance requirements being satisfied, every extra ton of grass consumed is capable of producing some 30 lb. of butterfat. Feed to the maximum capacity so as to increase the amount available for production.

Rushes and sedges are plants indicating stagnant water in the soil. This defect must be removed to secure high productivity in pastures or annually sown crops. Drainage, therefore, is the first improvement necessary on waterlogged soils.

Suitable soil, plenty of lime, presence of nodule bacteria, freedom from weeds, avoidance of continuous grazing, are the main factors concerned in successful lucerne-growing.

INSECT GROUPS ASSOCIATED WITH FORESTRY.

Extract from State Forest Service Bulletin No. 2, "Forest and Timber Insects in New Zealand," by DAVID MILLER, B.Sc., F.E.S., Entomologist, Department of Agriculture.

BEFORE dealing with the insect groups associated with forestry, the following brief account of insect characteristics will no doubt be of assistance to the better understanding of what is to follow.

Although insects are built upon characteristic lines, they exhibit a vast variation of the fundamental plan and habit. Many adult forms are winged, and others wingless. In the former there are typically two pairs of membranous wings attached, with the three pairs of legs, to the thorax or middle part of the body (Fig. 19). The abdomen or hind part of the body of the adult has no appendages of locomotion, but in the female of many species there is attached an appendage—the ovipositor—by means of which the eggs are placed in suitable position. From the egg—in the case of a moth or beetle, for example—a young grub or larva hatches and commences to feed, growing at the same time and moulting its skin more or less frequently until it is fully developed, when it transforms to an inactive pupa or resting stage, in which the final touches in the transformation from larva to adult take place. When this transformation is complete the pupa splits open and the fully grown insect emerges. In the case of many other insects, however, such as the eucalyptus psyllid (Fig. 75), or an aphid, the larva is not a grub, but resembles the adult in general form. As this young insect grows (Fig. 75 *c*) it sheds its skin, as the latter becomes too small, and grows a larger one. This moulting goes on, and the rudiments of the wings appear as small outgrowths on each side of the thorax (Fig. 75 *b*). By further moults there is a gradual transformation to the adult. There are, then, two general methods of insect-development: one, as in the moth or beetle, where there are four distinct stages each with a form and habits of its own—*i.e.*, egg, larva, pupa, adult; and the other where the young resemble the adult in all but size and mature characteristics.

The method of feeding varies also. In the case of adult beetles, and the larvæ of beetles and moths, &c., the head is armed with jaws enabling the insect to eat foliage or bore its way through the tissues of plants. In a scale insect, aphid, &c., the mouth-parts are modified as a delicate piercing structure, which is inserted into plant-tissues and the nutrient juices, or sap, sucked up.

BEETLES.

Beetles are readily distinguished by the hardened forewings forming a pair of covers or cases (elytra) which close over the body, only the fore part of the thorax remaining exposed, and beneath which the membranous hindwings are folded (Fig. 20). The following are the families of particular interest to the forester, although the characters given are not altogether typical for each family as a whole, but of such species as are of direct interest.

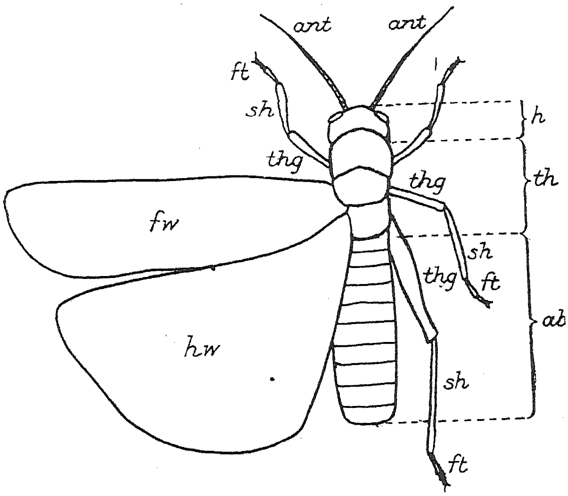

FIG. 19. DIAGRAM OF AN INSECT, SHOWING PRINCIPAL PARTS.

Ant, antennæ; *h*, head; *th*, thorax; *ab*, abdomen; *thg*, thigh; *sh*, shank; *ft*, foot; *fw*, forewing; *hw*, hindwing.

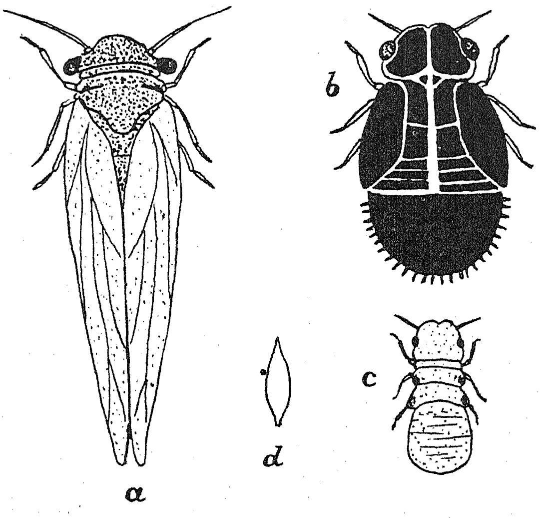

FIG. 75. EUCALYPTUS PSYLLID.

a, Adult; *b*, nymph; *c*, larva; *d*, egg. × 20.

The flat-headed borers (Buprestidae) are so called on account of the characteristic shape of many of the larvæ, which are legless or possess very rudimentary legs, and have the front segments of the body, behind a small head, greatly broadened and flattened, the remainder of the body being comparatively narrow and tail-like. The larvæ of certain buprestids which feed upon foliage are not of the flat-headed type, but are rather cylindrical in form, the body tapering from in front backwards. Some species are very destructive and bore shallow mines, as wide as the broadened part of the body, between the bark and sap of living trees, which are thus exposed to the depredations of other insects and eventually killed. The heart-wood may also be attacked by some buprestids. On the upper and lower side of the broadened end of the body is a thin flake-like plate, and a feature by which the larvæ of this family can be characterized is the inverted V-shaped groove on the upper plate. When the larvæ is fully developed it works its way to the bark, where it excavates a cell, just beneath the surface, in which the pupa lies. On the adult emerging it gnaws its way through the thin covering of bark to the open air. After mating, the female lays her eggs in wounds on the bark or in crevices, and the larvæ on hatching therefrom work their way into the tree, their tunnels widening as the larvæ grow in size.

This family is a very large one in the tropics, but is not extensively represented among the New Zealand beetles. There is one species said to be introduced.

The death-watch beetles (Ptinidae) form a group embracing the well-known and destructive so-called white-pine or common house-borer (*Anobium domesticum*), which infests dried timber. The beetles are very small, and may be recognized by the head bent downwards and covered from above by the front part of the thorax. The female lays her eggs in seasoned wood, particularly sap, and the larvæ burrow through in all directions, reducing the infested parts to a honeycombed mass, leaving nothing but an outer shell of wood. The pupæ transform within the burrows, and the adults on emerging cut a neat circular hole through the surface of the wood. Badly infested timber is punctured by innumerable holes, which the adults frequently re-enter to lay their eggs. The larvæ are small, whitish in colour, and soft-bodied and plump ; they lie in a characteristic doubled-up position within the wood, and their presence may be frequently detected by the quantities of fine wood-dust ejected through old openings on the surface. The most outstanding representative of this family in New Zealand is the cosmopolitan house-borer, but there are several native species, some of which will no doubt prove to be destructive.

The powder-post beetles (Bostrychidae) : Some of the species belonging to this family are amongst the most destructive, attacking living or dead timbers and finished products. The larvæ resemble in size and shape those of the Ptinidae. The species herein recorded are rather elongate and narrow, but there are others more robust in the adult stage. The beetles themselves burrow into the wood, and occur in the burrows inhabited by their larvæ. The powdered wood is not the fine dust as ejected by the ptinids, but consists of finely shredded particles. *Lyctus brunneus* is an example.

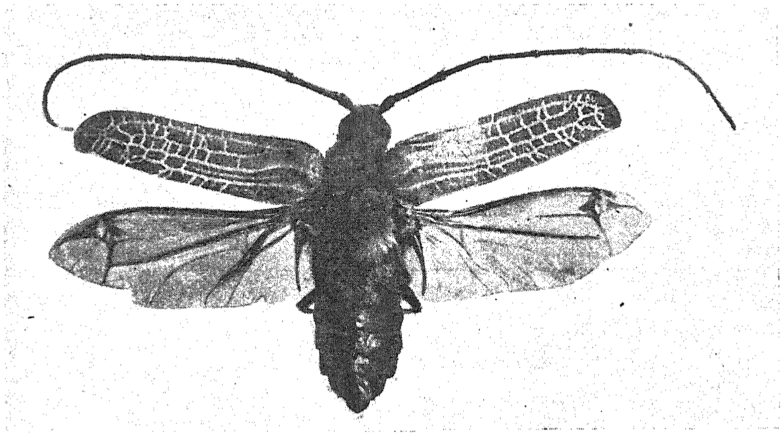

FIG. 20. HUHU BEETLE WITH WINGS EXPANDED,

Showing the hardened forewings, which form the wing-cases (elytra), and the membranous hindwings.

[*Photo by E. B. Levy.*

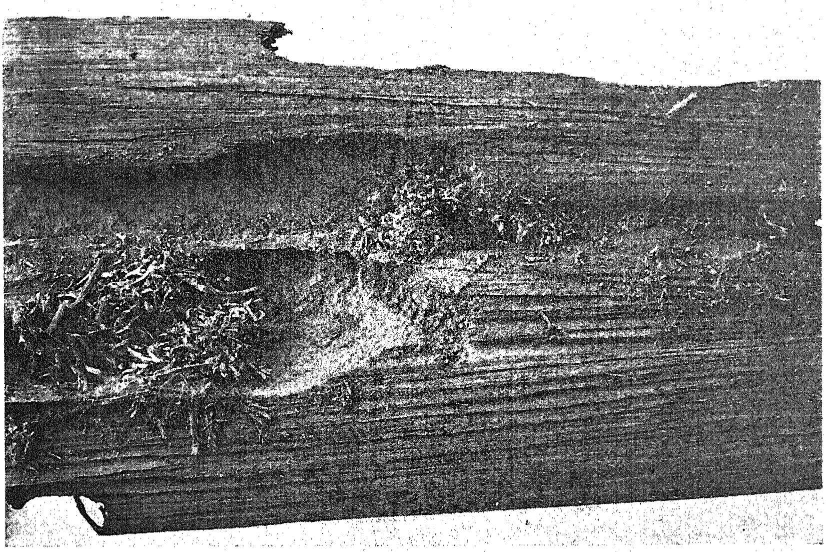

FIG. 107. WOOD ATTACKED BY HUHU LARVÆ. (NATURAL SIZE.)

The long-horned beetles (Cerambycidae) comprise a very large family of wood-borers, and there are a great many native species in the Dominion. The beetles themselves are readily recognized by their very long antennæ, in some species longer than the body, which is more or less elongate, often narrow, usually cylindrical, but sometimes rather flattened along the part covered by the wing-cases. Some are amongst our largest insects, while others are comparatively small. A number of them are powerful fliers, and emit a loud droning when on the wing, being frequently attracted to lights at night; others, again, are more or less sluggish, and remain motionless even when roughly disturbed. Several species when at rest create a distinct but faint squeak much like that made by an indiarubber "squeaking-doll." The stridulating-organ of these beetles is situated on the back, and consists of a triangular process projecting forward under the front part of the thorax from the middle of the body where the wing-cases are attached; the inner surface of the front part of the thorax is drawn over the point of this process and creates the characteristic squeak. Other species create a rasping sound by rubbing the hind thigh against the edges of the wing-cases. The larvæ have a small head and a fleshy cylindrical body, with the segments distinctly separated from each other. The front end is broadened, and tapers somewhat to the hind end, and in consequence the larvæ of this family are known as "round-headed borers" in distinction to the "flat-headed" buprestid type. While some of the cerambycid larvæ possess three pairs of very small legs, there are others which are quite legless and might readily be confused with some species of the buprestids; such are distinguished, however, by the absence of a V-shaped suture on the dorsal plate at the front end of the body of the cerambycid, and by the plate on the lower side being but imperfectly developed. A common cerambycid is the "huhu" beetle (Fig. 20).

The leaf-beetles (Chrysomelidae) are well represented among our native insects. The larvæ and adults of this family for the most part feed upon foliage. The larvæ are plump, and some of them are prominently coloured; some transform to pupæ on the leaves of their food plant, while others burrow into the ground for this purpose. The adults are usually oval in outline, with a strongly arched back; the antennæ are slender, but not usually long; the eggs are laid on foliage. The eucalyptus tortoise-beetle is an example.

The lamellicorn beetles (Scarabaeidae) differ greatly in the habits of the various species, of which there are a great many occurring in New Zealand. It is the group known as cockchafers with which the forester has to deal, since their larvæ are injurious to the roots of trees, particularly in nursery beds, and the adults to the foliage. The larvæ are readily recognized; they are white or cream-coloured, and live in the soil, lying doubled up in a characteristic attitude, the common "grass-grub" being a typical form. The beetle is stout in form, and the wing-cases do not cover the end of the abdomen, which protrudes much as if the wing-cases were a size too small for the beetle. The head is broad and blunt in front, and the short antennæ have the terminal joints produced on one side much like the fingers of a hand—hence the name "lamellicorn." The front legs are adapted for burrowing in the ground, the shanks being flattened and acting as shovels. Several species are nocturnal as adults, and when large

flights occur may cause considerable damage by defoliating trees. The eggs are laid in the ground, and the life-cycle of many of the New Zealand species takes a year to complete.

Weevils (Rhynchophora). This group of beetles is a very extensive and most important one from an economic standpoint, a great many species being prominent as borers in live and dead timbers; the larvæ are legless. There are four families, three of which are dealt with here. The typical weevils are easily recognized by the long trunk-like prolongation of the head, at the end of which the mouth and jaws are situated, but there are others which have not this character so prominently developed. The first family is the Brenthidae, represented in New Zealand by at least two species, commonly known

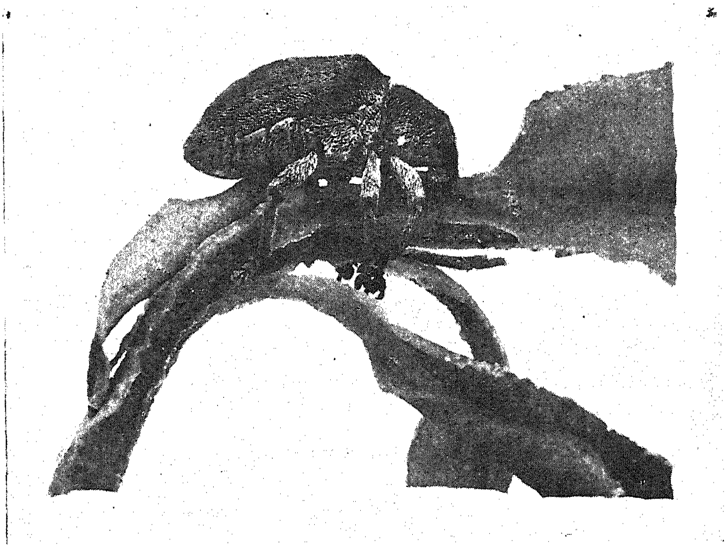

FIG. 89. THE EUCALYPTUS LEAF-WEEVIL: ADULT ATTACKING FOLIAGE. × 6.

[*Photo by E. B. Levy.*

as "giraffe-beetles" on account of the extremely long auger-like snout or beak by means of which the female bores a hole in dead wood in order to lay her eggs. The long-bodied cylindrical beetles vary considerably in size, and, contrary to the usual rule, the male is smaller than the female. The male has the antennæ situated at the tip of the snout, but on the female they are attached towards the middle. The larvæ bore through the wood and transform to pupæ in the burrows. The pupæ are easily recognized by the long snout doubled under the body with the legs.

The second family is the Curculionidae, or the typical weevils, and embraces most of the Rhynchophora; they all possess a distinctly developed snout (Fig. 89). The members of this family have a wide range in their depredations upon plant-life, both the adults and larvæ

frequently being responsible for considerable destruction. They are borers in the bark and wood of living and dead timbers, or they feed upon the foliage, roots, or fruit. In the case of borers the eggs are placed by the female within the tissues of the plant, her snout being used to construct a cavity for their reception ; the eggs of leaf-feeders are laid upon the foliage of the food plant.

The larvæ are plump and legless grubs, the front end being thicker than the posterior, and the body usually lies in a slightly curved position. By means of the strong jaws they are able to eat their way through woody tissues. The pupæ of the wood-borers transform in the burrows, but the larvæ living upon foliage may enter the ground to transform. The adults have a characteristic knack of abruptly dropping off a tree if alarmed, and lying perfectly motionless on the ground with the legs curled up close to the body. Many of the arboreal species when handled cling tenaciously to one's hand by means of a dense brush-like pad on the lower surface of the feet.

The Scolytid weevils (Scolytidae) comprise the third family, and many of them are most destructive to living, dead, or dying timbers. They are small beetles, the body being elongate and narrow or short and stout. They differ from most other weevils in the absence of a distinct snout. The short antennæ are elbowed, and each ends in a knob. The entrance to the burrows of the adults is marked by the quantities of finely shredded wood which accumulate at the orifice, and is very conspicuous upon the bark. The main burrow is constructed by the parent, and the eggs are laid therein, each small legless fleshy larva boring a burrow for itself off the parent tunnel.

MOTHS.

Moths are so well known as such that a lengthy description is hardly necessary ; they possess two pairs of wings, which are usually clothed with a powdery dust formed by innumerable minute scales ; they usually subsist on the secretion of flowers, &c., and the mouth-parts are in the form of a long sucking-tube, which is carried coiled like a watch-spring beneath the head when not in use. The moths themselves are not destructive ; it is their larvæ or caterpillars (Fig. 94) with which we have to contend. The latter are worm-like in shape, with a distinct head, and the mouth-parts, unlike those of the adult, consist of strong jaws and their accessory parts by means of which they devour foliage, fruits, seeds, or even bore through the woody parts of plants. The three segments behind the head correspond to the thorax, and on the under-side of each is a pair of short legs. There are no legs on the abdominal segments, but there may be from one to four pairs of abdominal sucker-like " pro-legs," as well as a pair on the last segment at the end of the body.

Two groups of outstanding importance are the tortricids (Tortricidae) and tineids (Tineidae). The moths of the former are small species of sombre colour, and when at rest the wings form a roof-like ridge over the body. The front wings are more or less blunt at the end. The caterpillars are small, and a great many of them are leaf-rollers, feeding upon and sheltering within the rolled leaves. Examples of such species are the elusive tortrix and the oblique tortrix. The tineid moths are much smaller insects, in many cases with the narrow,

more or less pointed wings, fringed with delicate hair. Some of the smallest moths belong to this group, their caterpillars mining in the tissues of the leaves. Other species tie leaves together (*Proteodes carnifex*) or cut off a piece of leaf and web it down as a covering to the surface. Some are gregarious (the gregarious tineid), while others feed exposed on leaves or attack fruits and seeds.

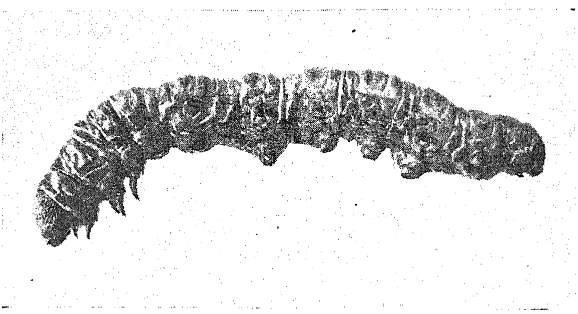

FIG. 94. FULL-GROWN LARVA OF GHOST MOTH. (ABOUT NATURAL SIZE.)

[*Photo by E. B. Levy.*

There are two groups of larger moths, the caterpillars of which are foliage-feeders for the most part. In one group (Geometridae) there is only a single pair of abdominal pro-legs on the caterpillars, which progress by a looping movement during locomotion. In the other group (Noctuidae) the caterpillars possess two or four pairs of abdominal pro-legs.

SAW-FLIES.

The saw-flies (Tenthredinoidea) are four-winged insects, and belong to the same group as the bees and wasps, from which they may be recognized by the fact that the abdomen is not restricted in the form of a waist where it joins the body, as is the case with bees, &c. By means of the stout ovipositor the female saws a cavity—hence the name "saw-fly"—through the bark or beneath the epidermis of the leaf, according to the species, and in the cavity so formed deposits an egg. The grub, on hatching, commences its attack upon the plant. The grubs of the species which deposit their eggs beneath the bark are borers, and pupate within the burrows (steel-blue saw-fly), but those hatching from the eggs on the leaves emerge and feed exposed upon the foliage, and when fully grown enter the soil to pupate (the well-known pear and cherry slug, *Eriocampoides limacina*, for example).

SCALE INSECTS.

These insects (Coccidae) are widespread in their depredations, causing an enormous amount of damage to living plants. They feed upon the nutrient juices, which they reach by puncturing the plant-tissues by means of their delicate proboscis, and when they are present in large numbers weaken the plant to such an extent that the death of the latter frequently results.

Of the various forms of insects injurious to vegetation the scale insects, as a family, are undoubtedly of major importance, since they feed not merely upon one group, or allied groups, of plants, as do so many other injurious insects, but an extensive range of widely different plants are subject to their depredation.

Scale insects are extremely abundant in most parts of New Zealand. The individual insects are usually small and inconspicuous, but, owing to the fact that they lead a stationary or semi-stationary existence, they readily form conspicuous incrusted or flocculent colonies upon infested plants, into the tissues of which, whether bark, leaf, or fruit, the female drives her thread-like beak or proboscis and feeds upon the juices of the plant. Although the amount of nutrient plant-fluid absorbed by a single scale insect, or even by a few, is infinitesimal, the loss to the plant when heavily infested is so great that the vitality is weakened and productivity reduced, in many cases death of the host eventually ensuing.

Frequently these insects exude a sticky product known as "honey-dew," which is so abundant at times as to form a coating upon the leaves, stems, and fruit, and hinders respiration to a great extent. Further, this honey-dew acts as an excellent medium for the growth of a sooty mould, which, forming a black film, gives an unsightly and fire-scorched appearance to the plant.

Generally speaking, there are two groups into which all the scale insects may be placed, and the life-cycle of each differs somewhat. One group is spoken of as the *covered scales*, since the insect lives beneath a scale-like covering separate from the body. Examples of such forms are the white rata-scale and the greedy scale. The other group is the *naked scales*, or forms which have no scale-like covering, but are in some cases protected by a toughening of the skin as the karaka-scale, or lie within a felted sac as in the gum-tree scale, or are covered merely by a powdery secretion as the various species of mealy bugs, or the cottony cushion scale.

The female of a covered scale deposits a large number of eggs beneath the protecting scale, which may be filled more or less completely, the parent insect shrinking in size and eventually dying as the total number of eggs is produced. In some cases the eggs hatch before they are extruded, so that the female gives birth to living young. The eggs first deposited are usually the first to hatch, so that the young larvæ do not emerge all at once, but over a longer or shorter period according to climatic conditions and species of scale. The minute young larvæ on emerging from beneath the parent covering possess six legs, and are very active, moving about over the infested plant in search of a favourable spot, into which they insert the delicate thread-like proboscis and commence to feed on the plant-juices. The young females remain attached to the one spot for the remainder of their existence, losing their legs before reaching maturity, and, after taking up this position, commence to form the first waxy covering which will become part of the fully developed protecting scale. To this first covering is attached a second one, and to the second a third, the three forming the completed scale covering.

The life-history of the male differs from that of the female. The male retains his legs and passes through a pupal or resting stage

before emerging as a minute two-winged insect with no mouth-parts.

The naked scales differ from the covered scales in the retention of the legs by the female throughout life, so that the insects are capable of moving from one place to another. In such species as the gum-tree scale the body is protected by a felted sac, within which the young are produced. On the other hand, such insects as the cottony cushion scale form a fluted fibrous sac attached to the body, in which the eggs are placed. The mealy bugs are covered with a powdery secretion, and the eggs are laid in a specially constructed woolly sac, in the strands of which they are entangled. As in the first group, the males are two-winged insects. In all scale insects the females are wingless and incapable of flight.

APHIDS.

The aphids (Aphidae), or plant-lice, attack plants in the same way as scale insects, and although as a rule they are not protected by any covering (Fig. 29) there are many forms, such as the pine-chermes and the woolly aphis of the apple, which protect themselves by a woolly

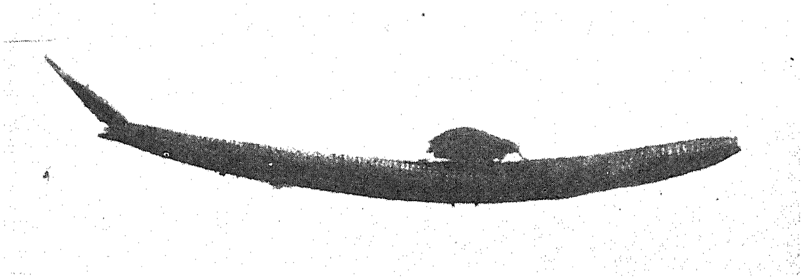

FIG. 29. GREEN SPRUCE-APHIS ON SPRUCE-NEEDLE.

Showing insect with its proboscis inserted in tissues.

[*Photo by E. B. Levy.*

secretion. During its development an aphis passes through various stages. If a colony be examined, winged and wingless individuals may be found. The wingless ones may be females only, and give birth (parthenogenetically) to living young resembling the mother in general form but being much smaller; these grow rapidly in size until mature, when the business of reproduction goes on. At certain times of the year some of these wingless forms develop into winged females and males. Many of these females deposit eggs from which the wingless parthenogenetic forms hatch. On the other hand, some winged females are parthenogenetic and reproduce living wingless forms.

GALL INSECTS.

Malformation of plant-tissues is frequently brought about through the agency of insects, many having a very injurious effect upon the development of the infested plants. These malformations are known as *galls*, and assume various forms upon the bark, roots, or leaves of plants. Some galls form pimples on the leaf-surfaces, or completely

curl up the whole leaf; some form nodules on the foliage or bark and roots, while others take the form of sacs, &c. Within the galls the insects or their grubs live. Some of the commonest gall-forming insects are the chalcid wasps, which belong to the same group as the saw-flies, bees, and ants. They lay their eggs within the tissues of the plant, and the grubs, on hatching, set up a local irritation of the tissues, causing the malformation. Another group of insects is the two-winged midges (Cecidomyiidae), the grubs of which affect plants in the same way as the chalcid wasps. Some scale insects, aphids, and even moths are gall-makers. Several species of mites also attack plants in this way, causing extensive damage.

BENEFICIAL INSECTS.

In a free state of nature no insect is injurious. The many forms feeding upon vegetation (phytophagous insects) are an important factor governing the abnormal increase of plant-life. Such insects are in turn held in check by other species preying upon them (the insect-feeding or entomophagous insects), and are consequently prevented from causing extensive destruction to vegetation. Each species, therefore, has its own particular use in the preservation of the natural equilibrium. However, when any of nature's products become of value to man, and the insects subsisting on such products hinder the standard of development required by man being attained, it is then that the insects in question become injurious. The phytophagous and entomophagous insects thus differ in their economic application; the natural utility of the former may become detrimental, while that of the latter remains constant, and may be utilized and even increased.

The entomophagous insects, according to their habits, are of two kinds—predators which seek out and capture their victims, and parasites which live upon or within their host insects. Such beneficial insects comprise a very extensive and varied group. A great many of them feed on no particular species of insect, and their utility from an economic standpoint is therefore of less value than those which specialize in their victims. The following general outline deals with the latter forms.

Among the predaceous species the larvæ of certain hover-flies (Syrphidae) are outstanding. These larvæ are rather slimy, legless, and blind, but can nevertheless move rapidly about a plant in search of scale insects, plant-lice, and even caterpillars, the body contents of which they suck dry. Two of the commonest species of hover-fly met with in New Zealand are the New Zealand syrphus and the banded melanostoma; they are recognized by their hovering flight, remaining motionless in the air before suddenly darting off to hover again a short distance from, or even at, the starting-point. The New Zealand syrphus measures about $\frac{3}{8}$ in. in length, and is of a blue-black colour, with four pairs of narrow orange-red or cream-coloured spots on the abdomen. The banded melanostoma is somewhat shorter, and on the black abdomen of the female are four pairs of dark-yellow spots. The abdomen of the male is almost altogether yellow owing to the spots being very large.

Most of the ladybird beetles (Coccinellidae), both in the adult and larval stage, are also important predaceous enemies of scale insects

and aphids. The beetles are small insects, and readily recognized by their oval and dome-shaped outline; in colour they are blue or black, frequently with red, yellow, or white spots. The larvæ are also characteristic; they have three pairs of well-developed legs, and the body is frequently clothed with spine-like hairs; they are sombre-coloured or pictured with red or yellow spots.

A very common predator frequently found associated with hover-fly larvæ and preying upon the same insects as ladybirds is the larva of the Tasmanian hemerobid. This larva is alligator-like, and possesses a pair of caliper-like jaws which are adapted for sucking up the body contents of the captured insects. The pupa is very often found in a small, silken, loosely spun cocoon attached to grass, &c. The adult insect is small and greyish, and carries the seemingly too large net-veined wings closed roof-like over the body.

The parasitic insects are represented by a host of species the larvæ of which, for the most part, live upon or within the bodies of other insects, more particularly during pre-adult development of the latter. A very great many of them are of incalculable value, especially those which confine their attention to one species, or group of allied species, of insects. The principal groups of parasites are the tachina-flies (Tachinidae) and the ichneumon and chalcid wasps. The tachina-flies comprise a very large family of two-winged insects, and there are a great many species native to New Zealand. They are bristly flies for the most part, and vary greatly in size, some being very small and others as large as a humble-bee; they are usually of sombre colour, and many closely resemble blue-bottles in size and appearance, but differ in having the abdomen very bristly, and in the large bristle of the antennæ being destitute of hair. A great many different kinds of insects are attacked by tachinid larvæ, but most of their activities are confined to the caterpillars of moths. That an enormous proportion of insects are destroyed by these larvæ is evidenced by the abundance of the adult flies.

The ichneumon and chalcid wasps are probably more abundant than the tachinids. They usually possess two pairs of wings, but some are wingless; they are slender insects, and vary greatly in length, some being large and others almost microscopic; the colour is black, red, golden, or yellow, and many species are spotted or banded. They belong to the same order as the bees and wasps, and may be recognized by their rather waspish appearance, the abdomen being attached to the body by a more or less conspicuous stalk. Many species have a longer or shorter thread-like "tail"—the ovipositor—by means of which the host insect is punctured and the eggs laid within. Though the larvæ of many species live within the body of the victim there are others that are external parasites.

NOTE.—Most of the figure-number references to illustrations, and all page references to related parts of the bulletin, have been omitted from the foregoing extract. If is not feasible to reprint here more than a few of the large number of relevant illustrations included in the bulletin.

The Dorset Horn breed of sheep is reported to be coming rapidly into favour in Australia as fat-lamb producers.

DESTRUCTION OF TALL COUCH.

EXPERIMENT IN MARLBOROUGH.

F. W. GREENWOOD, B.A., Instructor in Agriculture, Blenheim.

A SUCCESSFUL and instructive experiment in the destruction of tall couch (*Agropyron repens*) has recently been completed on the property of Mr. R. F. Goulter, Riverlea, Blenheim. The 40-acre block in question was very badly infested with this troublesome weed. In the 1923–24 season the crop grown was Algerian oats. Acting on the writer's advice Mr. Goulter decided to substitute the method of smother cropping for the more expensive, and in this case more unsatisfactory, method of summer fallowing and cultivation.

Accordingly the stubble, soon after the oat crop had been harvested, was ploughed to a depth of 4 in. and then worked down with the cultivator and harrows. In March, 1924, Algerian oats and Scotch

FIG. 1. THE 22-ACRE BLOCK IN FIELD SOWN WITH OATS AND TARES ON MR. GOULTER'S FARM.

This area was grazed almost continuously and has reverted to tall couch.

tares were sown at the rate of 2 bushels of oats and 1 bushel of tares per acre. During the succeeding winter this crop was grazed off-and-on with 400 ewes, a grass-paddock adjacent to the oat and tare field being employed as a run-off. In the following spring Mr. Goulter continued to graze 22 acres of the oat and tare crop. At the end of February, 1925, every lamb was sent away fat. This particular block, as will be seen from Fig. 1, has now run right back to couch. Of the remaining 18 acres, 12 acres were cut for hay early in November, 1924, but a block of 6 acres right in the centre of the field was left uncut, the tares being allowed to run to seed. The seed was harvested in February, 1925, yielding 33 bushels per acre, and was sold at 8s. per bushel.

On the 12-acre block which was cut for hay the couch has greatly decreased in quantity, but has not entirely disappeared (see Fig. 2.) On the block from which the seed crop was taken, however,

the couch has practically disappeared, the only plant now growing being the relatively harmless weed scarlet pimpernel, as seen in Fig. 3.

One of the most noteworthy features about this experiment is that with many farmers it is the practice to summer-fallow for a full season before sowing a smother crop. In Mr. Goulter's case the seeding of the tares has effected the desired result. The economy of this method is obvious.

FIG. 2. GROUND IN 12-ACRE BLOCK FROM WHICH A HAY CUT OF OATS AND TARES WAS TAKEN.

Cleaner than land in Fig. 1, but a fair number of couch-plants still present.

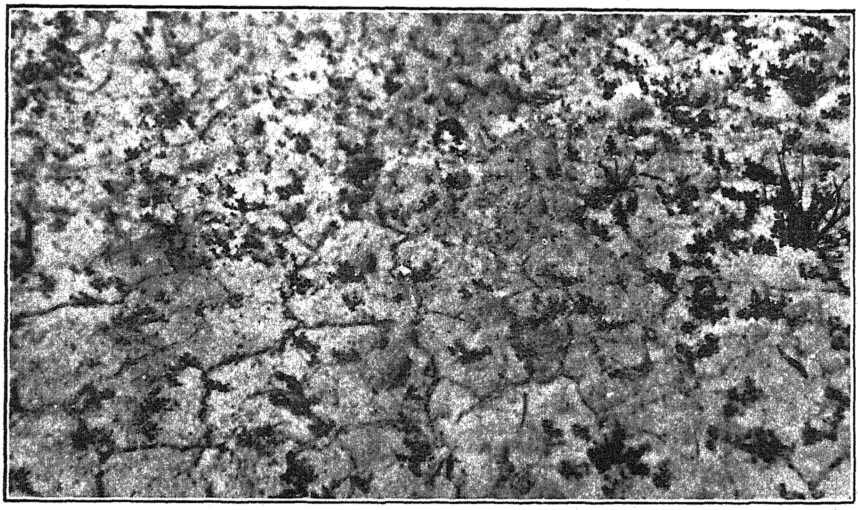

FIG. 3. GROUND IN 6-ACRE BLOCK FROM WHICH A SEED CROP OF TARES WAS TAKEN.

Note practical disappearance of couch—the small plants seen being seedlings of scarlet pimpernel, a relatively harmless weed.

TESTING OF PUREBRED DAIRY COWS.

JANUARY CERTIFICATE-OF-RECORD LIST.

W. M. SINGLETON, Director of the Dairy Division.

IT was hoped that the appended list—giving particulars of certificates issued in January—would complete the publication of records gained in the calendar year 1925. Owing, however, to the delay of a number of breeders in reporting dates of calving subsequent to test, or in returning declarations of milk-weights, &c., there are still a considerable number of records outstanding. It is expected to publish the closing list in next month's *Journal*.

While the present list does not include any new class-leaders, there are several good performances. It will be noted that one Jersey, four Friesians, and one Milking Shorthorn have each yielded over 700 lb. butterfat.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
		JERSEYS.				
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Woodstock Finality	Mrs A. Banks and Son, Kiwitea	1 280	240·5	365	10,267·8	566·08
Erinview Perfection	J. Murray, Woodville	2 16	242·1	365	9,521·2	532·22
Glyndyfrdwy Victoria	P. McNaughton, Morrinsville	2 50	245·5	365	8,565·4	531·98
Gay Twylish	A. Devine, Tamahere	2 55	246·0	364	8,070·4	521·83
Carhuduff Oxford Lily	J. O'Donnell, Bunnythorpe	2 5	241·0	365	9,422·1	499·62
Mountain View Goldie	H. C. Rogers, Mangatoki	2 3	240·8	365	8,868·0	450·82
Makanui Lady	H. G. Livingston, Kiwitea	1 315	240·5	365	7,335·7	430·90
Linwood Molina	W. V. Hosking, Stratford	1 354	240·5	310	7,777·6	425·65
Tozzie	J. A. Pettigrew, Pihama	2 20	242·5	365	7,428·5	407·20
Grasmere Glitter	H. J. Berry, Kaupokonui	1 332	240·5	365	7,936·8	385·88
Rewa Macaroni	W. H. Booth, Carterton	2 44	244·9	365	6,708·4	376·12
Dainty's Respect	B. Hey, Riverlea	2 14	241·9	340	7,100·2	374·75
Alzie	J. A. Pettigrew, Pihama	1 349	240·5	365	6,785·5	370·53
Curzal	J. A. Pettigrew, Pihama	2 33	243·8	365	6,385·5	364·50
Pine Bank Viola's Goldie	J. Meuli, Normanby	2 16	242·1	365	7,009·0	357·63
Clarissa's Gold	J. S. T. Short, Hawera	2 63	246·8	330	7,733·8	355·48
Eileen Joy	F. V. Bryant, Ruawhata	1 311	240·5	335	7,410·6	351·08
Grasmere Maiden	H. J. Berry, Kaupokonui	1 342	240·5	365	6,465·0	346·56
Ringlet's Dairy Maid	F. V. Bryant, Ruawhata	1 336	240·5	325	5,642·5	339·46
Consuela	W. V. Hosking, Stratford	1 340	240·5	323	5,852·8	323·29
Grasmere Endowment	H. J. Berry, Kaupokonui	1 310	240·5	276	5,893·6	275·96
Grasmere Ideal	H. J. Berry, Kaupokonui	2 15	242·0	288	5,329·0	253·80
Senior Two-year-old.						
Floral Eminent*	G. E. Yelchich, Waiuku	2 248	265·3	365	10,359·2	597·43
Riverswood Bright Eyes	J. Nicolson, Kaupokonui	2 237	264·2	365	8,827·0	452·57
The Gay Empress	Mrs. C. Waterhouse, Waverley	2 344	274·9	343	8,926·7	426·22
Noble's Girlie	B. Hey, Riverlea	2 123	252·8	365	7,878·2	413·48
Makanui Rachel	H. G. Livingston, Kiwitea	2 107	251·2	365	7,149·5	375·77

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS—*continued.*						
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Hurden Queen ..	G. E. Cowling, Manaia ..	3 339	310·9	365	8,703·4	571·51
Woodstock Free Lady	Mrs. A. Banks and Son, Kiwitea	3 18	278·8	365	9,651·7	562·65
Some Girl	J. E. Rae, Taneatua ..	3 354	312·4	365	9,181·4	487·21
Pine Bank Bonny Maid	J. Meuli, Normanby ..	3 322	309·2	365	6,686·9	401·40
Four-year-old.						
The Real Lady ..	G. E. Cowling, Manaia ..	4 349	348·4	314	8,352·8	517·01
Kate's Violet ..	F. Phillips, Otorohanga ..	4 324	345·9	365	8,267·1	440·18
Mature.						
Willow Bank Molly ..	J. O'Donnell, Bunnythorpe	6 77	350·0	365	15,584·6	776·59
Orange Dale's Larkspur	W. J. Hall and Son, Matatoki	5 57	350·0	365	10,501·5	629·57
Miro Meadows Countess	A. A. Ward, Tariki ..	5 332	350·0	365	9,518·5	538·02
Sappho's Model ..	S. Dale, Fairlie	6 363	350·0	307	8,686·1	535·56
Trethella's War Baby	F. Phillips, Otorohanga ..	6 86	350·0	365	9,841·2	529·41
Bob Tail	J. S. T. Short, Hawera ..	6 154	350·0	365	9,727·8	524·75
Red Gold	G. E. Cowling, Manaia ..	8 335	350·0	365	8,802·8	522·09
Maori Thora ..	J. Poletti, Bell Block ..	7 55	350·0	365	9,474·3	505·33
Rose of the Meadows	G. E. Cowling, Manaia ..	10 136	350·0	365	9,560·5	493·98
Orchestra	J. S. T. Short, Hawera ..	8 17	350·0	365	9,269·4	486·74
Coy Kilcoy.. ..	C. Stevens, Maungatapere ..	5 22	350·0	365	8,314·2	479·21
Majesty's Hopeful ..	Mrs. S. R. Lancaster, Palmerston North	6 261	350·0	365	10,143·4	458·12
Majesty's Dewdrop ..	F. Phillips, Otorohanga ..	7 342	350·0	365	10,075·7	453·21
Una's Zealous ..	A. S. Lamb, Tatuanui ..	6 323	350·0	347	7,764·2	447·11
Oakvale's Starlight ..	A. S. Lamb, Tatuanui ..	5 362	350·0	365	7,719·3	445·50
Maori Magpie ..	J. Poletti, Bell Block ..	6 340	350·0	312	7,276·0	390·95
FRIESIANS.						
Junior Two-year-old.						
Ngatoro Johanna Princess*	C. W. Baldwin and Sons, Inglewood	2 25	243·0	365	18,725·7	619·05
Ormsby Hartog Queen*	John Court, Ltd., Auckland	2 28	243·3	365	13,536·2	484·19
Johanna Posch of Oakview*	H. R. Green, Kairanga ..	2 139	254·4	293	12,205·0	450·26
Colinton Venus* ..	R. Colee, Greendale ..	1 317	240·5	365	10,069·1	390·24
Hanley Gem ..	G. H. Hassall, Clarkville ..	2 84	248·9	365	10,072·9	333·39
Senior Two-year-old.						
Tinie Evergreens* ..	John Court, Ltd., Auckland	2 364	276·9	358	13,313·7	389·03
Junior Three-year-old.						
Bainfield Sylvia Betty*	R. K. Macdonald, Edendale	3 120	289·0	334	11,368·8	391·09
Friens Hengerveld Gipsy†	D. Dickie, Wellington ..	3 55	282·5	286	9,338·8	343·81
Ellerlea Ena Minto de Kol*	A. C. M. Finlayson, Kamo..	3 59	282·9	160	8,134·4	294·56
Senior Four-year-old.						
Domino Posch of Oakview*	H. R. Green, Kairanga ..	4 327	346·2	365	21,734·8	799·28
Pietertje Dutchland Abbekerk*	H. R. Green, Kairanga ..	4 295	343·0	365	20,945·0	714·35

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS—*continued.*						
Senior Four-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Dominion Daughter of Domino	Central Development Farm, Weraroa	4 337	347·2	365	10,092·8	384·76
Mature.						
Rosevale Burkeyje Sylvia*	H. North and Sons, Omimi	7 0	350·0	365	19,571·5	724·65
De Kol Lulu of Hawkridge*	Piri Land Company, Auckland	6 355	350·0	365	18,701·4	705·26
Fairmont Pietertje Lady*	James Hart, Tatuanui ..	5 49	350·0	365	20,184·9	688·96
Glenmore Pearl* ..	R. S. Riddler, Ohakune ..	11 2	350·0	365	15,099·7	582·41
Manor de Kol Beets of Ashlynn*	F. G. Wayne, Parawai ..	10 16	350·0	365	17,071·7	578·86
Dominion Miss Mierlo	Central Development Farm, Weraroa	6 29	350·0	348	16,562·5	554·42
Friens Mercedes† ..	D. Dickie, Wellington ..	5 300	350·0	365	15,301·2	493·75
Colantha Tirania Segis 2nd	J. C. O'Rorke, Opunake ..	5 325	350·0	365	14,072·1	450·89
Pietertje Queen Manola*	Matangi Friesian Farm, Matangi	6 44	350·0	233	10,569·1	440·73
MILKING SHORTHORNS.						
Junior Two-year-old.						
Willowbank Tangi's Floral 2nd	W. J. Holmes, Runciman ..	1 353	240·5	365	11,108·9	441·37
Junior Four-year-old.						
Willow Banks Beryl†	W. H. Simms and Sons, Ltd., Christchurch	4 42	317·7	365	9,993·1	475·19
Sunnymeade Pearl ..	W. J. Holmes, Runciman ..	4 61	319·6	365	9,811·6	437·26
Braebank Red Lady	W. J. Holmes, Runciman ..	4 23	315·8	306	8,990·7	359·19
Mature.						
Kaitawa Meg 2nd† ..	J. H. Mason, Reid's Line ..	6 342	350·0	365	17,141·5	716·04
Matangi Winsome's Wonder†	W. H. Simms and Sons, Ltd., Christchurch	5 77	350·0	363	13,876·2	615·59
Rouken Glen Belle ..	Wood Bros., Karaka ..	6 122	350·0	365	13,685·3	558·90
Zest of Waimea ..	R. V. Brown, Weraroa ..	7 335	350·0	365	12,776·2	535·14
Matangi Jimmy 2nd..	R. V. Brown, Weraroa ..	5 41	350·0	365	12,480·3	526·95
Waimea Laurel ..	R. V. Brown, Weraroa ..	5 359	350·0	326	11,651·0	500·26
Pukerimu Dolly 14th	John Fisher, Pukerimu ..	8 263	350·0	306	9,363·6	363·31
AYRSHIRES.						
Two-year-old.						
Maesgwyn Mignonette†	C. M. Williams, Ohoka ..	2 93	249·8	365	9,844·1	416·79
Maesgwyn Clover† ..	C. M. Williams, Ohoka ..	1 347	240·5	365	12,047·3	386·17
Four-year-old.						
Maesgwyn Joy† ..	C. M. Williams, Ohoka ..	4 283	341·8	349	15,160·6	583·12
Mature.						
Generosity of Woodlands	Robertson and Blackley, New Plymouth	7 289	350·0	365	12,929·3	570·48

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		Second-class Certificates.				
		Jerseys.				
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Twinks	L. and J. Griffith, Weraroa	2 17	242·2	365	10,203·2	555·54
Sea View Polly ..	G. H. Bell, Oakura ..	1 333	240·5	365	6,207·9	306·00
Three-year-old.						
Pinewoods Silver Link	G. H. Bell, Oakura ..	3 349	311·9	365	10,360·2	630·39
Mature.						
Ulysses' Bilberry ..	G. H. Bell, Oakura ..	5 303	350·0	365	8,172·4	503·82
		Friesians.				
Mature.						
Pareora Gyda* ..	A. S. Elworthy, Timaru ..	7 3	350·0	365	16,252·4	528·63

OCCUPATION AND UTILIZATION OF LAND IN NEW ZEALAND.

THE following table summarizes the condition of occupied land in the Dominion for 1924 and 1925 :—

—	1924.	1925.
	Acres.	Acres.
Orchards, market gardens, vineyards, nurseries, and seed-gardens	34,567	32,747
Crops	1,681,922	1,768,303
Area occupied by residences, outbuildings, gardens, &c.	61,648	63,206
Fallow land	160,945	124,459
Sown grasses	16,447,570	16,450,625
Phormium tenax (New Zealand flax)	43,180	54,814
Tussock and other native grasses	14,806,237	14,470,990
Fern, scrub, &c.	3,827,517	4,054,760
Plantation	66,056	71,218
Standing virgin bush	4,411,730	4,331,333
Barren and unproductive land	2,031,192	2,209,917
Totals	43,572,564	43,632,372

In this table " barren " land is defined as that which is incapable of being put to profitable use, and not merely that which is barren because unused. Types of this land are mountain-tops, cliff-faces, shingle-beds, &c. It must be recalled that this table does not profess to give the condition of all land, as the total area of the Dominion is 66,390,262 acres, whilst the area occupied in 1925 was returned as 43,632,372 acres—a difference of 22,757,890 acres.

—*Census and Statistics Office.*

HON. O. J. HAWKEN,

MINISTER OF AGRICULTURE.

Appointed 18th January, 1926.

SEASONAL NOTES.

THE FARM.

AUTUMN SOWING OF PERMANENT PASTURE.

AT the higher altitudes which are subject to heavy frosts spring sowing of pastures is preferable, particularly if the mixture used is heavy in clover content. On coastal lands and the lower country generally it will be found as a rule that the best pastures are obtained from autumn sowings, and March is probably the best month for this purpose. A mixture suitable to the soil and locality should be chosen, and great care should be given to the selection of the seed to ensure that nothing but the best is purchased, and that it is reasonably free from weeds and of good germination. The question of cover-crops is much discussed, but it may be accepted as a general principle that pasture mixtures are best sown alone. The exceptions are very late autumn sowings, or where the field is in a very exposed position. In cases of this sort it is permissible to put in a bushel of white oats or barley. Algerian oats are not very suitable, as they are slower in coming away and persist rather long in the spring. For cultivated land about 40 lb. of seed is a suitable sowing per acre. This will, of course, be dependent upon the mixture, but as a rule somewhere between 35 lb. and 45 lb. will prove sufficient.

Standard mixtures for various conditions of soil and situation have been published from time to time in the *Journal*, and many will be found in the Department's "Grasslands" bulletin. Local experience must always be given due weight, especially in connection with mixtures for unploughable hill country. The district Instructors in Agriculture are always ready to advise in cases of doubt.

In order to grow good pasture, land must be in a good state of fertility, and, if the soil is at all run out or low in plant food, fertilizers should be applied with the seed or put on as soon as possible after sowing. From 1½ cwt. to 3 cwt. of any good phosphatic manure is suitable, such as superphosphate, basic super, basic slag, or half-and-half mixtures of super and ground rock phosphate or super and blood-and-bone. On ploughed land, if the seed-bed has been well prepared and consolidated, covering the seed with a light set of tine harrows will give a satisfactory result, nothing more being required. If, on the other hand, the seed-bed is inclined to be loose and dry it is best to complete operations with the Cambridge roller.

FORAGE CROPS.

The sowing of cereal mixtures as advised last month should be pushed on, so that they may be well established before cold weather sets in. Oats and vetches sown now may be used as green feed for sheep or milking cows in the spring. Where the system of farming tends to eliminate leguminous crops by the continuous growth of cereals and crucifers, oats and vetches are particularly valuable for keeping up the nitrogen content of the soil and ensuring high fertility. Cape or Black Skinless barley can still be sown for feed in autumn.

For winter feed, especially where turnips have failed or are at best uncertain, Algerian oats may be sown.

Western Wolths or Italian rye-grass sown now provides good spring feed, and may later be shut up for a seed crop. Temporary pastures of Italian rye-grass and red clover may be laid down on land that does not become too wet in the winter. This can be grazed in May or June, and again in the spring, periods which are very important from the feeding standpoint. Dairy cattle that can be given a good start for the winter will generally maintain their condition.

Maize and Japanese millet should be fed with the intention of utilizing all before the middle of April, and if surplus crops of these are likely to occur they should be converted into ensilage. It is a good policy to plough the land immediately maize, millet, and soft turnips are removed. This will keep down the weeds, and it also saves time when the land is prepared for spring feed.

In the North, sowing of the hardier varieties of soft turnips, such as Devonshire Greystone, for winter feed may be continued in March.

RED CLOVER SOWN ON WHEAT.

Red clover sown across the wheat crop in the spring generally comes away well after the cereal is harvested, if there is sufficient rain. It can be very profitably utilized, together with second growths of rape and kale, for flushing ewes before tupping. If the crop has undergone dry conditions during summer, inspection may show that there are a good number of weakly clover-plants in the stubble. By keeping the sheep off the field, and later top-dressing with 1 cwt. super when a good rain is assured, this clover will be very useful for spring feeding. Ewes milk particularly well on it. Later the crop may be spelled and then fed in breaks to fatten the lambs. The last breaks are the best for this purpose—that is, when the clover hardens off and is in full flower. Care should be taken not to allow sheep to become engorged with clover, especially when rank and after rain. A grass-pasture run-off should be provided.

AUTUMN SKIM-PLOUGHING.

Under Canterbury conditions too much emphasis cannot be laid on the importance of early autumn skimming. Stubble land of oats, and oats and vetches, and later of wheat and rape, should be worked up as soon as harvesting operations will allow, so as to kill weeds, conserve moisture, and obtain that deep easily worked tilth which means profitable crops. On farms where the land is still so hard as to make skimming difficult with a team, the work of a strong rigid-tine cultivator, or disks with plenty of cut on them—tractor-drawn—should pay handsomely.

THE LINSEED CROP.

The linseed crop will be ready for harvesting early in March. It should be allowed to remain in stook until sufficiently dry; this will take from two to three weeks. The crop may be threshed from the stook or be stacked. Evidence to hand this season in Canterbury indicates that linseed does best when sown on lea land. Several cases have indicated the undesirability of following turnips

with linseed. The general impression that linseed is an exhausting crop is not borne out by Canterbury experience, as it is frequently found to be a good preparation crop for wheat.

Growing of "Bill Moose" seed is increasing, as the heads of this variety are considerably larger than those of the ordinary type. Owing to the seed itself being much larger, sowings of from 40 lb. upwards should be made, whereas with the old type of linseed from 25 lb. to 30 lb. prove quite sufficient.

LUCERNE.

Lucerne sown last spring should be ready for a second cut about the end of the coming month, and if the weather is dry this cutting should be followed by two or three strokes of the tine harrows or a very light cultivator. It may be recommended to then drill in 1 bushel of Algerian oats with 1 cwt. super per acre and leave the stand until spring. The oats will shelter the young lucerne and keep down the grass and weeds. Old lucerne stands that have not already had attention should be thoroughly cleaned up as advised in last month's notes. When properly cleaned a method well worth consideration is to drill in 1 bushel of oats or Italian rye-grass, which will fill up all bare ground and help to suppress undesirable growth. This will give a good early crop for feeding out or making into ensilage. Several stands treated in this manner in the autumn of last year gave up to 12 tons of green material per acre in the spring. Careful observations indicated that the introduction of the oats or rye-grass had very little effect on the subsequent growth of lucerne. In any case, such effect was confined to the first cut after the oats were removed, and this was more than compensated for by the extra weight of material obtained and the improved condition of the land.

Established stands of lucerne may be grazed moderately from now on till the end of the growing season, but young stands are better not grazed at all during the first year. Where it is considered that a lucerne stand requires lime, this is best applied in autumn.

IRRIGATION FARMING.

In Central Otago, settlers practising irrigation must make provision to carry out the final watering of their land in March, as the supply of water from the races will be cut off at the end of that month. This especially applies to the soaking with water of uncultivated land intended to be broken up. There is no doubt that by this means ploughing is made easier and more satisfactory. A start should be made to break up new land, and this operation not left till winter, when in all probability the ground will be frozen too hard for ploughing.

WATERING-PLACES FOR STOCK.

Stock at this time of the year often suffer from an inadequate supply of drinking-water. The falling-off in milk-yield, often attributed to a decrease in the quality of the grass, can be partly traced to this deficiency. Watering-places should be cleared out and made accessible to stock by the formation of a sloping bank. A load or two of gravel covering the bed of the stream and the approach to it does much to keep these places clean.

—*Fields Division.*

THE ORCHARD.

FRUIT EXPORT.

THE efforts of commercial fruitgrowers will now be concentrated on the harvesting of the season's crop, and in some localities the preparation of apples and pears for export will be foremost.

The methods employed in this branch of the business vary considerably. Where the quantity handled is not large the fruit is usually picked and packed by the grower himself or under his own personal supervision, and picking and packing can be carried out with the idea that any extra care and time spent at the picking will be a distinct advantage at the grading and packing table. In early packings every care should be taken that all fruit, as far as possible, is above the minimum size allowed for the variety, otherwise the small fruits are wasted; whereas if left on the tree they would be included in the next picking, having then attained the size required.

Likewise all fruit below standard can be discarded at the first handling. This is not always done, and much time is wasted at the grading and packing table which could be avoided if such fruit was thrown out when picking. Where large quantities are being harvested, and the fruit graded and packed in community packing-sheds, or by packing contractors, joint action between pickers and packers is of great importance. It is not enough that pickers should be concerned only in making available a supply of fruit for the shed, but that the cases should be delivered containing the least possible quantity of useless fruit.

For those who have not had previous experience in export business a few hints may be useful regarding handling of the fruit generally. If picking-bags are being used, be careful not to overfill them, and do not be in too great a hurry when tipping the contents into the boxes. Carelessness results in scratches and stem punctures. Pick direct into the cases whenever convenient, but, if they are export cases, see that they are not unduly soiled in the process. Sometimes accidents will happen and cases of fruit are spilled. Do not fancy that the contents of these are not bruised, and include them in the bulk. Put them on one side for a while, and then sort carefully. Before grading or packing, study carefully the regulations covering these matters. The Orchard Instructor for the district will give his advice on the practical side should it be required. There are many little points in connection with fruit export which do not strike the beginner, but have been found out by experience to be of value in the process of assembling, such as the proper construction of the cases, the use of certain-sized papers, proper methods of wiring, care in labelling and stamping, the proper use of wood-wool, and other items that make for successful working.

LOCAL MARKETING.

Though the foregoing notes deal exclusively with export, the writer is well aware that this concerns only about 25 per cent. of the production, and that our own markets must receive every consideration as regards methods employed. One cannot but be

impressed with the fact that experience is teaching that greater concentration must be directed to this end. Universal and uniform grading, and the elimination of that class of fruit characterized as culls from our present lower grades, appear to be essential. At present one can only emphasize the necessity for careful attention on the part of growers in the disposal of their local-market fruit, whether for private sale or on the open markets of the Dominion.

SPRAYING.

The later varieties of apples which will not be picked for several weeks may still receive arsenate of lead for the control of leaf-roller and codlin-moth, where such precaution is still necessary. Also where red mite is still to be feared, lime-sulphur treatment may be continued; if used alone this should not cause spray-stains. Attention is also drawn to the possibility of a late infection of black-spot on such varieties as Statesman, Dougherty, Sturmer, Cleopatra, Yates, and possibly others in some localities. Lime-sulphur may still be applied to guard against loss from this cause should circumstances be favourable for the development of spot.

—*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

Work for the coming month will consist of maintaining a clean state of cultivation, with the soil constantly well worked. A further application of bordeaux, 4–4–40, is also advisable for fungus troubles. If young scales or thrips show up during this period an insecticidal spray of oil, 1–40, should be applied to prevent them becoming established. Stopping of unduly extended young growth should also be attended to. —*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CULLING.

MARCH is a busy month on the poultry plant, for at that period much important work must be carried out. In the first place, the main culling of the flock should be undertaken, and it is of the first importance—with wheat at its present price—that every inferior bird be weeded out.

For those who have not studied laying form throughout the season some general points may be stated that will serve as a guide towards culling out the poor layers. Other things being equal as to the time of hatching, and when the flock has received uniform treatment in regard to feeding and general management, it will usually be found a safe course to discard the birds that moult first, and to retain the late moulters either for breeding or laying purposes. Other indications of poor laying-power are overfatness (above the standard weight of their breed), well-kept plumage, and any signs of weak constitutions, such as a dull, sunken eye, loose feathering, sluggish appearance, lack of abdominal development, and anything denoting unhealthy condition. In the case of the breeds with yellow legs, such as Leghorns, Plymouth Rocks, &c., it will generally be found at this

season of the year that those which have lost the deep-yellow colour—the legs having become more or less white and bleached-looking—are the best layers and the strongest birds in the flock, whereas those with legs of a rich yellow are the drones. It is well to reiterate, in view of the high cost of food, that no sentiment must be allowed to enter into this essential work of weeding out unprofitable stock.

A great weakness on some plants is the practice of holding on to old male birds. Very often the general appearance of these is sufficient to indicate that they will be little, if any, use for another breeding season. Such stock are a constant drain on the profits. If a male is not worth using again he should be got rid of as quickly as possible. It should be needless to mention that all surplus cockerels that have attained a marketable age—four and a half to five months—should be marketed without delay.

Not only does efficient culling save food without reducing profits, but it also does away with overcrowding, one of the worst faults connected with poultry-keeping.

THE WINTER LAYERS.

It is now full time for all pullets to be placed in their permanent winter quarters, as it is always best to have them well accustomed to their surroundings before they reach the laying-point. Any change of quarters or food when they are nearing that stage is liable to cause a false moult. In addition to providing uniform conditions in this respect, special care should be taken for the comfort of the stock, so that a maximum egg-yield may be produced. Everything, in short, should be done to prevent the birds receiving a setback.

An abundant supply of sound grain material, a daily ration of both green and animal food, also grit, crushed oyster-shell, and provision for dusting-places are of great importance. Also the quarters should be kept clean, and the floor well covered with scratching-material, in which the whole grain ration should be fed to induce exercise. Above all, care should be taken that the birds are not compelled to sleep in a draught, or colds will soon appear at the expense of the egg-yield. Present indications are that fresh eggs will command a high level of value during the coming winter. Thus any time spent now in making the pullets comfortable and keeping them in a healthy thriving condition should be well repaid.

THE BREEDING-HENS.

The importance must be emphasized of selecting next season's breeding-hens before the moulting-period generally sets in. Indeed, if this important work is delayed now it will be impossible for it to be carried out to the best advantage at a later date. This is because if it is left till the flock has fully moulted the signs indicating that a hen has laid well during the past season (and is most likely to do so in the future) will have vanished. In choosing the best hens to breed from it is the long-season layers—in other words, the late moulters—that are most desired. This, however, is not to say that all late moulters and heavy layers are necessarily ideal breeding-stock. Something more is required. In addition, the bird should conform to the

utility-standard requirements of the breed it represents, both in breed type and weight. That is to say, it should be a slightly larger specimen than the average bird kept in a laying-flock. The great essential of all is the possession of undoubted constitutional vigour, sign-posts to which are a clean face, bold prominent eyes, tight feathering, a well-developed crop, and an active businesslike appearance.

After selecting the best breeding specimens and carefully marking them everything should be done to keep them in the best of health. There is nothing more conducive to this than a good range under the most natural conditions possible. This will give the birds an opportunity to recuperate and build up their bodily vigour before being called upon to lay eggs for hatching purposes. One of the great essentials in the breeding of profitable stock is not only having the right class of parents, but in handling these to the very best advantage right up to mating-time.

TUBERCULOSIS.

Now that the hens are finishing up an exhausting laying season and are not in a vigorous condition they are liable to become affected with this dreaded disease should they come in contact with the germ. A sharp lookout should therefore be kept to detect birds showing signs of being affected. As a rule the first outward symptom is an unthrifty appearance and a rapid wasting of flesh which is most noticeable surrounding the breast-bone, the latter standing out as a sharp ridge. It will also be observed that the bird has a listless appearance and seldom mixes with other members of the flock. As the disease advances, a yellow and in some cases a mixed green diarrhœa sets in. Another common symptom is a limp, generally on the right leg. Under post-mortem examination the liver will usually be found spotted with yellow nodules. For this reason the disease is often termed by poultry-keepers "spotted liver."

It is useless trying to doctor a bird affected with tuberculosis, and all that show signs of being affected should be killed and burnt. Prevention is the one and only safe course of dealing with this disease. The first essential is to breed birds with the necessary constitutional vigour to resist the infection. Then, the value of good feeding and clean, well-ventilated houses is most important, while, above all, the runs should never be allowed to get into what is termed a poultry-sick condition. A double run to each house, whereby one can be spelled, cropped, and allowed to sweeten while the other is being used, is an essential for the maintenance of clean ground and a healthy thriving flock.

BROODING DUCKLINGS.

Several cases have come under my notice lately of ducklings losing the power of their legs during the brooder stage. This condition is usually the result of allowing the birds to sleep in damp quarters. Although ducks are a water fowl, the artificially produced duckling will cease to thrive if compelled to sleep on damp bedding or where a moist atmosphere exists. Once a duckling loses the power of its legs little or nothing can be done for it. It is merely a question of prevention by checking everything that tends to create a moist atmosphere. In the first place, the drinking-vessels should be placed

well away from the sleeping-quarters, a practice that will help to keep the latter dry; also ample ventilation should be provided and the quarters kept clean. Do not on any account overcrowd ducklings by placing more in the brooder than it can properly accommodate. Work only with numbers that can be handled with absolute confidence. Overcrowding and insufficient ventilation are bad enough, but where this is accompanied by insanitary conditions disastrous results are sure to follow. An even degree of heat, good ventilation, and cleanliness are essential factors in rearing brooder ducklings.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

FINAL EXTRACTING.

WHERE extracting has been delayed for any reason it is advisable to use great caution in removing the honey. The combs should be removed as expeditiously as possible, and care must be exercised not to incite the bees to rob by keeping the hives open longer than it is necessary to remove the surplus. A hasty examination of the brood-chamber should be made in case it is found that the bees have not filled the combs in the lower story with honey. If empty or partly filled combs are found it is highly important that they be replaced with good combs of honey from the super. On no account attempt to extract any honey from the brood-chamber. Do not leave combs lying about or expose vessels that have contained honey. Unless caution is exercised in regard to these details, when the final extracting is being done the beekeeper is more than likely to start the bees robbing in a wholesale manner.

PREPARATION FOR WINTER.

The time is at hand when it is of paramount importance that proper preparation be made for winter. If the colonies are to winter in good order, so as to escape the abnormal winter losses which sometimes occur, then it behoves the beekeeper to attend to the leading factors that produce successful wintering. The attendant evils of neglect are starvation, spring dwindling, and poor colonies, these latter being of little account when the next season's crop arrives.

There are many factors in preparing the colonies for winter, and among the most important which make for success are a strong cluster of bees, a good queen, plenty of good stores, and protection. It is safe to say that too little attention is paid to wintering the colonies with strong clusters of young bees. Having secured a crop of honey, and noting that the colonies are strong in bees, the beekeeper is satisfied to trust to chance. At the close of the season the colonies are likely to contain a large force of bees, but the majority, having helped to gather the season's crop, are old, and in consequence cannot be taken into account in wintering the colony. As a result, unless large numbers of young bees are being raised to take the place of the old bees, the colonies will seriously dwindle in the spring or become a total loss in the winter. Every effort must be made to keep up breeding well into the winter, and it is often advantageous to stimuate the colonies by autumn feeding.

Next in importance to having a strong cluster of young bees is the necessity for the colony to be headed by a good queen. Too little attention is paid to superseding failing queens. A queen that has laid vigorously during the honey season is likely to become worn out and her powers of reproduction diminished. In all cases these queens should be replaced and a vigorous young mother supplied. It often happens that the bees recognize a failing queen, and set to work to supersede her, but this work should be anticipated by the beekeeper. Other things being equal, stocks headed by a vigorous mother are likely to keep up late breeding, with a result that the colonies will come out in the spring with a prolific queen, and the loss attendant upon queenless hives will be greatly diminished.

If the beekeeper studies his interests and the welfare of his bees he will note that every colony goes into winter quarters with plenty of good stores. This is a most important factor in successful wintering, and upon it depends largely the staving-off of starvation which faces the bees during the months which follow. The colonies that are supplied with honey winter safely and build up early in the spring, and are ready to take advantage of the nectar from the early-flowering plants. Beginners often ask how much honey should be left for the bees to winter on. The amount necessary must to some extent depend upon locality, and care must be exercised, more particularly in the South, to provide sufficient so that winter feeding may not have to be resorted to. In the North, winter feeding may be successfully carried out, as there is not the same risk in breaking up the clusters as there is in the extreme South. In no case should a colony be left with less than 30 lb. of sealed honey, and it is wise to increase this amount to 40 lb. Abundance of stores is essential if winter losses are to be eliminated altogether.

Another important factor in the safe wintering of bees is that of protection. This may be provided for bees by housing them in a good watertight hive and protecting them by good shelter hedges or fences. Great annual winter losses occur in this country through lack of attention to hives, more particularly to the roofs. Leaky roofs are an abomination, and should not be tolerated under any circumstances. By allowing the roofs to leak the mats and hives become damp, and the consequent drain on the stores is largely in order to keep up the heat of the cluster for safe wintering. It is safe to state that where the bees are kept dry the amount of food consumed to keep up the heat of the cluster will be small as compared with the stores eaten by the bees where proper protection has not been afforded by the beekeeper. New Zealand in general being a wind-swept country, it behoves the beekeeper to see that the bees are located in a sheltered position. Cold winds militate against brood-rearing, while they also prevent the bees from taking a cleansing flight during the spring months.

CARE OF COMB-HONEY.

There are factors in the proper treatment and care of comb-honey which the producer is apt to overlook when putting his honey on the market. Usually the practice followed is to despatch the crop to market, where it is sold, to be afterwards graded and cleaned by buyers who are alive to the demands of the local market. These buyers obtain a better price by grading and cleaning the comb-honey,

whereas the producer can, by employing proper methods, demand an increased price. Comb-honey should be fully capped before removal from the hive, and it should not be left until its white appearance is destroyed by travel stain, this being caused by the constant traffic in the hive. When the sections are removed they should be stored in a warm, dry room, as low temperatures hasten granulation, and granulated comb-honey is not likely to meet with ready sale. Moreover, comb-honey stored in a cold, damp place is apt to " weep " (or absorb moisture from the atmosphere), forming beads on the surface of the comb, and in the course of time becomes sour, thus destroying its marketable value. As opportunity allows, the sections should be cleaned of all propolis and stain, and this is best done by scraping the sections with a knife, and the operation finally completed by sandpaper. Care must be exercised not to damage the cappings of the comb and thus destroy its attractiveness.

Before forwarding the honey to market it should be carefully graded, and finally packed in cartons for the market. By the use of cartons the sections are secured from dust and insects, and present an attractive appearance when offered for sale, besides being far less liable to breakage. In order to ensure safe transit, excellent shipping-cases can be purchased from the hive-dealers. These cases are fitted with corrugated-paper cushions, which materially reduce the breakage from rough handling. A feature of these section crates is a sliding-cover which enables the honey to be readily examined. The crates are appreciated by the retailers, and at the same time help to increase the average price to the producer.

E. A. Earp, Senior Apiary Instructor.

HORTICULTURE.

VEGETABLE-GROWING.

AUTUMN rains will encourage strong growth of weeds and crops. Crops half-grown will suffer seriously if this competition is allowed to continue. Advantage should be taken of fine weather, and specially bright mornings, to go through crops autumn sown or planted and weed them thoroughly. Crops nearing maturity fully occupy the ground and afford little opportunity for weeds to become established.

If seed of cabbage and cauliflower for early spring cutting is not already sown, prepare beds for the purpose and sow without delay. Prepare also a piece of warm, well-drained land for planting them out during the month of March or April.

On the lighter land and in the more humid districts the main onion crop is sown in March for planting out in early spring. Sow the seed rather deep and thin on clean ground, and afterwards commence the preparation of a piece of moist, well-drained, rich, friable soil on which to plant out the seedlings. These operations need to be carefully timed to suit localities, and the importance of the onion, spring cabbage, and cauliflower crops demands they be carried out in a thorough manner.

Runner beans, marrows, cucumbers, and the like, where cropping well, should be regularly picked over as the crops mature. Generous

watering, feeding, and mulching will often lengthen the cropping-period and increase the returns.

Lift potato and onion crops as soon as they mature and the weather is fine and the land dry. To allow opportunities for harvesting to pass is taking serious risks. If the weather is unsettled, move the onion crop into a dry, open, airy shed to ripen. Where the potato crop has been rogued during summer by marking the plants with sticks, secure the fruits of that labour by sorting out that which is desirable for replanting another season. To allow decayed and broken tubers to be mixed into the bulk sample, as is so often done, is storing up trouble for the future and increasing work. Easy sales and satisfied customers may be made and kept if careful sorters and pickers are engaged and the right grade maintained Cool, dark, ventilated sheds are best for keeping potatoes any length of time, and then only the soundest stocks should be stored.

Continue to give attention to the permanent crops of rhubarb and asparagus. Some feeding with manures in early spring is too often the only attention they receive besides the close cutting of sticks over a too lengthy season. More important is it to maintain attention during summer and autumn, so that strong plants are built up to ensure good spring growth. Do not allow the plants to become dry; feed them from time to time during the growing-period; and, most important of all, if growing in an exposed situation, protect the maturing growth of the asparagus, especially along the windward side.

Leeks and celery, too, require generous treatment, almost weekly, and never must they be allowed to dry out. Give a little extra attention before earthing up; remove suckers and damaged leaves. Tie the plants up carefully when the foliage is dry, and earth them up when the soil is friable and fine.

Where an abundance of fresh stable manure is available mushroom-spawn may now be planted.

GLASSHOUSE WORK.

Excellent reports are coming to hand from other parts of the world regarding the new method of cyanide fumigation of glasshouses. In the past potassium, and later sodium cyanide, has been used for the purpose of destroying injurious insects in glasshouses. In calcium cyanide, it is claimed, one has a material just as effective, cheaper, easier to use, and practically without danger to the operator. Tomato-growers or others wishing to give this cyanide a trial can receive further particulars on application.

Tomato-growers accustomed to follow on the main crop with a crop of dwarf beans might consider growing French runner beans instead. This practice is spoken highly of by some of those who have tried it.

PREPARATION OF SOIL FOR BOXES.

The preparation of soil for the seed and plant boxes is sometimes deferred until the day it is required. This is most unwise. It is often the cause of those fungi becoming epidemic which cause "damping off," "stem-canker," &c. The stacking and turning of the quantity of soil required for this work is a big undertaking, but

it cannot be avoided, as it is a necessary factor in successful cropping. To the well-decayed fresh loam that should already be on hand, add now sharp sand, manures, and lime, &c., as required, and mix them well, and again from time to time before required in spring. This treatment thoroughly incorporates each ingredient, sets up a suitable fermentation, and encourages the germination of seeds and spores and their ultimate destruction. Seeds sown and plants pricked out into this class of soil can be expected to give good results, with a minimum of those worrying diseases and uneven growth that is such a feature under other conditions. The preparation of this soil should be undertaken without delay—if it has not already been done.

SMALL-FRUITS.

In the small-fruit section, which is so often neglected at this season, returns will be increased considerably if timely attention is given and the important autumn season is made the most of. Clean up strawberry plantings that are to be carried over; spray them with bordeaux, and hoe out weeds and runners, thus assisting the plants to a good recovery from the past fruiting season and putting them in good heart for the next.

Raspberry and loganberry breaks that still carry the old fruiting-canes should have them removed, and the new canes sprayed with bordeaux in which arsenate of lead is mixed. Most blocks of gooseberry and currant bushes would also benefit greatly from the application of this spray at the present time.

TOBACCO.

Crops of tobacco reaching the ripening stage will now be increasing in number. Cutting the leaf on the first fine day after rain is to be avoided, as it is then thin and watery; the gums and other constituents that give the leaf quality are actively secreted only in fine weather. Harvest the leaf with care, remembering that torn, broken, and bruised leaves are at a discount. Especially is this to be remembered in the curing-shed, where leaves should on no account be handled in a dry, brittle condition. Make every effort to get control of the ventilation of these sheds. Where they have been adapted it is sometimes difficult to do this, but until it is done the crop is very largely at the mercy of the weather.

LAWNS AND GREENS.

On the lighter lands, especially in the warmer districts, lawns and greens are best sown down during the month of March. Carry out now the preliminary work of cultivation and thoroughly cleaning the ground, smoothing it out approximately to grade, and letting it settle down to a firm bed. Give it a shallow hoeing from time to time to destroy weed seedlings and maintain a fine surface tilth. Before sowing, true up the surface and consolidate the bed, and then broadcast the seeds. The latter should be kinds and varieties suited to the locality, and free from seeds of weeds.

Lawns in a weedy condition can usually be improved by feeding them at the present time with dressings of the more soluble fertilizers Cut them now only moderately close, and follow this up with ample rolling with a heavy roller. —*W. C. Hyde. Horticulturist.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

SICKNESS IN CATTLE ON FERN-INFESTED COUNTRY.

L. J. W., Whatoro :—

Any information you can give me regarding cattle dying through eating young fern-shoots will be very welcome. The chief symptoms are that the cattle fall away, have a nasty cough, and bleed at the nose; the bowels appear to be normal. What is the cure for this sickness?

The Live-stock Division :—

The symptoms described are not characteristic of what is popularly believed to be fern poisoning. In such cases there is a rise of temperature, blood-tinged discharges from the mouth and nose, blood-stained acute diarrhœa, great depression, coma, and death in from twelve to seventy-two hours after the onset of symptoms. It is possible that your cattle grazing get the ash or pollen of the young fern-shoots into the nostrils, which sets up irritation, causing the animal to rub the nose on stumps, posts, &c., and that this tends to local hæmorrhage. We would advise you to remove the cattle if possible from the fern-infested pastures on to better-class country, and supplement their feed by the addition of a few handfuls of linseed nuts and bran daily until their condition shows general improvement. It would also be advisable to give each affected animal 12 oz. Epsom salts and one tablespoonful of ginger in a quart of oatmeal gruel sweetened with molasses.

BONE-CHEWING COWS.

"IRONSTONE," Halcombe :—

My cows of late have taken greatly to chewing bones and pieces of wood, and I should be glad to know what I should do for this trouble. The cows have been grazing on top-dressed land for some years now.

The Live-stock Division :—

The symptoms certainly point to deficiency disease, and apparently the top-dressed pastures have not proved sufficient in all directions. We would advise the following mixture to be given at milking-time: ½ lb. crushed bone-meal, 1 lb. bran, and a handful of coarse salt.

FOWLS WITH FOOT TROUBLE.

"POULTRY," Methven :—

A few months ago one of my fowls got lame, the foot swelled, and it had somewhat the appearance of club-root in cabbage-plants. Since then half a dozen of the birds have become affected, and are limping. They have a good roost and wide perches. Can you give any reason and remedy for the trouble?

The Live-stock Division :—

The birds are probably suffering from corns. This trouble is usually due to continuous hard pressure, caused by having high perches and a hard floor, whereby the birds injure their feet in alighting from the perch. Hard or stony runs are often responsible, while in odd cases a prick from a thorn, or a piece of fine glass becoming embedded in the foot, will bring about a similar condition. Perches should not be higher than 15 in. from the ground, and there should be ample litter on the floor to provide a soft landing. If the birds are valuable and worth giving personal attention to, painting the affected parts with iodine is a simple and often effective treatment, or they may be treated with a bluestone

solution. Dissolve a piece of bluestone about the size of a walnut in half a pint of hot water, and when the solution is cool dip the affected foot into it. Repeat this daily for a week or more. The birds should not be allowed to perch, and should be provided with soft bedding. Frequent dressings of vaseline or similar preparation may be afterwards applied to keep the feet soft.

SOIL-TREATMENT FOR HALCOMBE FARM.

"IRONSTONE," Halcombe :—

The soil of my farm, near Halcombe, is very heavy; it gets very wet and waterlogged in winter and goes dry and hard in summer. The old pastures seem to be running to rushes, sweet vernal, fiorin, and danthonia. The soil has an ironstone pan, and is full of little pieces of ironstone, and seems to be sour. Would you recommend me to use superphosphate with my crops and for top-dressing, or would basic slag be better ?

The Fields Division :—

Your land is evidently typical of the district, and indicates a bad physical condition of soil from want of drainage and lime. Heavy tenacious clays, being very fine in particle, absorb moisture slowly, and naturally give up surplus moisture as slowly; hence they remain waterlogged for long periods every season, which encourages a plant-growth such as rushes, fiorin, &c., and is detrimental to the growth of the better pasture plants. Under cultivation such soils are very difficult to work satisfactorily, and the growing season is considerably shortened as a consequence of the surplus moisture having to be removed by evaporation (a cooling process), instead of by efficient under-drainage. If the pan mentioned is a sufficient distance from the surface to allow of mole drainage being carried out at a depth of from 18 in. to 20 in. every 8 ft., efficient drainage should be accomplished. This should be followed by liming, at not less than 1 ton per acre of crushed limestone. As well as correcting excessive acidity, lime floculates clay soils and thus opens the top soil, permitting surplus moisture to percolate more freely to the drains. Only under such conditions (good drainage) can a maximum result be obtained from lime or manures. If for any reason such improvement cannot be affected and you have definite knowledge that the soil is very acid, it would be advisable to use alkaline manures such as basic slag or basic super.

COW WITH SCAB ON TEAT.

"J. K.," Matamata :—

I have a cow with a hard scab on the side of one teat about the size of a shilling, and beneath the scab the teat is also hard. I have been bathing it with hot water, but this has made no impression. I should be glad to have advice.

The Live-stock Division :—

Probably the best treatment would be to soften the scab by soaking the teat well in hot water containing washing-soda, and then removing the scab, afterwards cleaning the surface and applying some zinc ointment, which you can obtain from a chemist. Treatment would be more successful if you could dry off the cow, because, owing to the difficulty in properly milking a teat that has become hard and tumified, there is always a danger of the quarter becoming infected and mammitis following.

VAGINITIS IN DAIRY HERD.

"READER," Southland :—

I am milking a herd of forty-two cows, and fully half of them have a white discharge lodging on the tail and back parts of the cows. My two-year-old heifers were badly affected, and I have even noticed it on the back parts of a sixteen-months-old heifer. This season four cows and three two-year-old heifers failed to come in, and they were animals that I believed to be in calf, and on all of these I noticed the same symptoms. I washed the cows that were affected frequently with a solution of Condy's crystals, both this year as well as last. A number of

my cows returned to the bull last year, and several are coming back this year. I should be glad of advice.

The Live-stock Division :—

From your description of the symptoms the trouble seems to be infectious inflammation of the lining membrane of the genital passage, known as vaginitis. This disease is seen more frequently in heifers and young cows than in animals of more mature years, and is often the cause of difficulty of getting in calf and sterility, as was your experience last season. It is readily transmitted from cow to cow by the bull, while he himself may show no noticeable signs of trouble. The discharge from affected animals is highly infectious, therefore it is necessary in order to prevent spread that they should be kept apart from the healthy cows. Daily douching with a mild warm antiseptic solution such as Lysol, 1–100, or permanganate of potash, 1–500, alternated with a baking-soda (4 oz. to gallon) or common-salt solution (1 oz. to gallon) is beneficial. Strong irritating injections are harmful. The douching should be continued for some time after the discharge has ceased, and the cows should not on any account be put to the bull until all symptoms have subsided. The tail and hind quarters where the discharge may soil should be frequently washed with any reliable disinfectant. The bull should undergo treatment by clipping off the long hairs at the point of the sheath and injecting a solution of corrosive sublimate, 1–1000, or one tablet to a whisky-bottleful of water. It is necessary that the tablet be thoroughly dissolved and the solution injected at blood heat from a rubber enema. After injection the point of the sheath should be grasped and the fluid worked back so that the solution may come in contact with the whole of the parts inside.

HORSE WITH SEEDY TOE.

" SETTLER," Canvastown :—

I have a young horse affected by seedy toe. The horn is separated from the laminæ considerably, the separation being in some parts 2 in. deep or more. At present the foot so affected is without a shoe, and the horse goes slightly lame on it. What treatment can I give to help it to come right and keep it right ?

The Live-stock Division :—

The condition known as " seedy toe " is really a false growth of horn, due to imperfect secretion. Treatment advised is as follows: Remove all decayed and imperfectly formed horn (this is essential) ; if necessary, have the animal shod with a shoe having shield to protect part where horn has been removed ; apply a cantharides blister (1–8) to the hoof-head.

MINERALS IN CALF-FEEDING.

" PERPLEXED," Alton :—

Having read in the last December issue of the *Journal* that a calf requires 1 oz. of lime per day, and that 1 gallon of milk (the quantity that I feed per day) contains only ¼ oz., I should like to know how this deficiency should be made up. Also, would the addition of a little bone-meal be beneficial ?

The Live-stock Division :—

Although a gallon of milk fed daily to a calf does not contain the necessary amount of lime required to build up its tissue, a certain amount is contained in the herbage eaten, which under ordinary circumstances should supply the amount required. Should there be a deficiency a little finely powdered bone-meal added to the milk would be beneficial. Calves, however, cannot be reared satisfactorily on skim-milk alone. In addition calf-meal should be fed daily. This is probably the best method of adding the necessary ingredients that the young animal requires.

Drainage removes excessive soil-water, and its place is taken by air. Warmth then penetrates the soil and prolongs the growing season. These improvements encourage deep rooting and preserve the crop in times of drought.

WEATHER RECORDS: JANUARY, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE month of January opened with strong southerly winds, and cold, squally, and showery conditions prevailed on the 1st and 2nd over most of the Dominion, the effect of a severe disturbance which developed off the east coast. Thereafter, however, temperatures were more in keeping with the season, and, though occasional spells of unsettled and wet conditions were experienced, warm and fair weather predominated. Between the 9th and 12th an ex-tropical disturbance which moved down the western coast brought some good rains to both Islands. This was particularly beneficial to Central Otago in terminating a long spell of dry weather.

The most unsettled period during the month was generally experienced between the 20th and 24th. The North Island (particularly its northern districts) was under the influence of a cyclone passing in the north on the 21st and 22nd, and a severe easterly gale, with heavy rain, inflicted considerable damage on orchards and gardens. At the same time a storm area passing in the south caused northerly gales and boisterous conditions over the South Island. Our observer at Pokororo, in the Nelson District, reported that 8·21 in. of rain fell in ten hours on the 22nd, causing a record flood.

The total rainfall for the month was above the average in all but the east-coast districts, and the deficiency there was not so serious as in the previous month, so that conditions generally seem to have been favourable to farming pursuits.

—*D. C. Bates, Director.*

RAINFALL FOR JANUARY, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	9·28	10	4·50	3·36
Russell	7·49	5	5·15	4·54
Whangarei	10·65	15	2·36	3·63
Auckland	4·04	12	1·06	2·59
Hamilton	5·24	20	1·10	3·70
Kawhia	5·05	19	1·20	3·37
New Plymouth	5·06	17	1·13	4·32
Riversdale, Inglewood	7·64	15	1·80	7·43
Whangamomona	6·84	20	2·33	5·82
Tairua, Thames	3·90	8	1·84	4·12
Tauranga	5·37	11	1·55	4·40
Maraehako Station, Opotiki	6·38	10	1·48	2·87
Gisborne	1·81	9	0·67	2·77
Taupo	4·64	11	1·45	3·46
Napier	1·25	13	0·37	2·44
Maraekakaho Station, Hastings	1·62	12	0·46	2·29
Taihape	3·28	16	0·76	3·03
Masterton	1·25	8	0·30	2·62
Patea	5·06	15	1·12	3·38
Wanganui	4·13	11	0·90	2·84
Foxton	2·76	13	1·00	1·99
Wellington	3·08	13	0·68	3·30
South Island.				
Westport	6·03	20	1·63	6·80
Greymouth	10·42	20	1·81	9·04
Hokitika	12·40	19	2·34	9·87

RAINFALL FOR JANUARY, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Arthur's Pass	16·54	16	3·10	6·75
Ross	13·36	16	2·06	12·04
Okuru, Westland	14·51	16	3·01	12·86
Collingwood	10·05	20	3·58	6·95
Nelson	4·09	16	1·50	2·71
Spring Creek, Blenheim ..	1·73	14	0·72	2·22
Tophouse	6 62	15	2·05	5·16
Hanmer Springs	3·04	15	0·80	3·30
Highfield, Waiau	1·74	10	0·40	2·84
Gore Bay	1·11	9	0·40	2·47
Christchurch	1·67	14	0·78	2·21
Timaru	0·94	10	0·56	2·28
Lambrook Station, Fairlie ..	1·68	5	0·66	2·34
Benmore Station, Omarama ..	4·36	9	1·87	2·66
Oamaru	1·33	12	0·63	2·15
Queenstown	2·34	9	0·60	2·71
Clyde	2·36	6	0·70	1·72
Dunedin	2·41	13	0·67	3·41
Gore	2·96	13	0·90	3·34
Wendon	3·61	8	1·53	3·52
Invercargill	2·64	15	0·62	4·14
Puysegur Point	12·06	19	1·82	7·22

CLASSIFICATION OF CATTLE IN NEW ZEALAND.

FOLLOWING are particulars of cattle in the Dominion (including boroughs) for the last two years' enumeration, as compiled by the Census and Statistics Office :—

—	Number on 31st Jan., 1924.	Number on 31st Jan., 1925.
Bulls two years old and over, for stud—		
For beef purposes	12,136	12,679
For dairy purposes	46,798	47,141
Steers two years old and over*	433,575	405,768
Steers and bulls one and under two years old	189,569	189,801
Cows and heifers two years old and over, for dairying—		
In milk	1,167,914	1,178,504
Dry	124,372	124,625
Other cows and heifers two years old and over ..	487,651	518,284
Heifers one and under two years old ..	438,084	441,510
Calves (heifer, steer, and bull) under one year old	630,130	552,164
In boroughs, &c.	33,268	33,268
Totals	3,563,497	3,503,744

* Including bulls not kept for stud purposes.

Eggs and Egg-pulp in Cold Storage.—The Government Statistician gives the result of the collection of this information at 31st December, 1925, as follows: Eggs in shell, 34,962 dozen; egg-pulp, 912,476 lb.; frozen whites, 556 lb.; egg-yolk, nil.

ESTIMATED YIELDS OF WHEAT AND OATS.

THE following estimated average yields per acre of wheat and oats for the season 1925–26 have been compiled by the Government Statistician from reports furnished by Inspectors of the Department of Agriculture throughout the Dominion, and issued under date 9th February, 1926 :—

District.	Wheat. Bushels per Acre.	Oats. Bushels per Acre.
North Island	26·45	28·84
Nelson	19·05	24·01
Marlborough	29·86	34·43
Canterbury	28·85	33·39
Otago	32·69	42·59
Southland	33·55	43·10
Average (estimated) for the Dominion, season 1925–26	29·06	35·83
Average (actual) for the Dominion, season 1924–25	32·62	38·72

In accordance with the above estimates, the total yield of wheat for the Dominion should be approximately 4,600,000 bushels, as against an actual yield of 5,447,758 bushels for the season 1924–25.

The percentage of oats threshed for the five seasons ending with 1924–25 was 26·95 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 3,700,000 bushels, as against an actual yield of 5,707,174 bushels for the season 1924–25.

FOREST AND TIMBER INSECTS IN NEW ZEALAND.

A VALUABLE publication bearing this title has recently been issued by the State Forest Service as Bulletin No. 2, the author being Mr. David Miller, Entomologist to the Department of Agriculture. In its seventy-six pages of printed matter the bulletin covers a wide field, treating of forest conditions, the importation of insect-infested timber, control, &c., in addition to dealing with over a hundred species of insects. Appended to the text are some hundred and fifty illustrations, a number of diagrams, and several maps. A section of the bulletin, together with several illustrations, is reprinted elsewhere in this issue of the *Journal*, and indicates the quality of the work. The price of the publication is 4s., including postage.

FORTHCOMING AGRICULTURAL SHOWS.

Rotorua A. and P. Association: Rotorua, 19th and 20th February.
Buller A. and P. Association : Westport, 19th and 20th February.
Northern Wairoa A. and P. Association : Mititai, 20th February.
Waiapu P. and I. Association : Ruatorea, 23rd and 24th February.
Tauranga A. and P. Association : Tauranga, 24th February.
Ohura A., P., H., and I. Association : Nihoniho, 25th February.
North Kaipara Agricultural Association : Paparoa, 25th February.
Franklin A. and P. Association : Pukekohe, 26th and 27th February.
Omaha and Pakiri A. and H. Association : Leigh, 27th February.
Taranaki Metropolitan Agricultural Society : New Plymouth, 3rd and 4th March.
Waikato Central A. Association : Cambridge, 3rd and 4th March.
Opotiki A. and P. Association : Opotiki, 9th March.
Morrinsville A. and P. Society : Morrinsville, 10th March.
Hawke's Bay A. and P. Society : Autumn Show, Tomoana, 16th and 17th March.
Mayfield A. and P. Association : Mayfield, 20th March.
Methven A. and P. Association : Methven, 25th March.
Temuka and Geraldine A. and P. Association : Winchester, 25th March.

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THE CONTROL OF WEEDS.

PRINCIPLES AND METHODS.

A. H. COCKAYNE, Director of the Fields Division.

I. INTRODUCTION.

A WEED has been defined as a plant growing in the wrong place. Under such a definition an oat-plant in a wheat crop is a weed, and, conversely, a wheat-plant in an oat crop is likewise a weed. Such a definition from the farming standpoint is of very little value. In any consideration as to whether a plant is a weed or not, the character of the land, the use to which it is put, and the type of farm-management desired to be adopted have all to be taken into consideration. The main characteristic that determines whether a plant is a weed or not is whether it exercises a detrimental effect on the production from the farm. Generally speaking, it is the type of crop grown rather than the plant itself that is the determining factor. This only emphasizes the fact that the same plant may be a weed under certain conditions and not under others. For instance, fat-hen, often a bad weed limiting production in spring-grown crops, is never a weed either in autumn-sown crops or in established grassland.

Broadly expressed, land may either be used for the production of grass or the production of annually sown crops. In other words, a sharp distinction has to be made between arable land, regularly under the influence of tillage implements, and grassland, where tillage implements other than the chain or tripod harrows are not ordinarily used during the life of the pasture. Grassland itself, however, varies in duration from only a few years, when the land is ploughed and resown with grass or used for a series of years for annual cropping, to truly permanent pasture never broken up either for grass-establishment or arable farming. These two great divisions of land-utilization for grass and annual-crop production naturally divide weeds into two classes—grassland weeds and annual-crop weeds. At times, however, the same plant may be both a grassland and an annual-crop weed, an outstanding example being Californian thistle; but even in this case the plant is a far more serious weed of arable land than it is of grassland. In addition to these two groups, consideration has also to be paid to weeds of certain special crops such as lucerne or cow-grass for

seed-production, crops that last more than one year but hardly come under either category. Orchard weeds, again, have to be separately considered.

Apart from land occupied by crops or by pasture, considerable areas of a farm may consist of land used neither for cropping nor grazing. This can be looked upon as waste land so far as production is concerned. Again, there are wide areas in a more or less unimproved condition, and, although they may be used to a certain extent for grazing, they are awaiting the expenditure of money or the adoption of special stocking-systems to bring them into an improved condition.

From the foregoing considerations one can outline a rough land-classification so far as weeds are concerned, as follows :—

(1.) Land devoted to the growing of annual crops—cereals, green feed, roots, and vegetables.

(2.) Land devoted to the growing of crops that last more than one year, such as lucerne, or orchards, where cultivation can be carried out in the established crop.

(3.) Land devoted to the growing of grass where no cultivation can be regularly adopted after establishment, classified as temporary, short-rotation, long-rotation, and permanent grassland.

(4.) Land used neither for cropping nor grazing — odd corners of farms, land too steep for stock, roadways, stockyards, drains, hedges, plantations, &c.

(5.) Land in an unimproved condition, the vegetation of which is either natural or has been brought about by the feeding and trampling of stock without any original cultivation or sowing. This type is divided into two main classes. The first is where special methods—drainage, burning, and sowing, combined with stock manipulation—are necessary to bring the land into production, such as swamps, unburnt forest, and fern and scrub. The other type is where perhaps no special methods will ever be made to improve the carrying-capacity other than by intermittent spelling of the country. The great example of this type of country is the tussock and mountain-run country of the higher elevations of the eastern part of the South Island.

With this preliminary introduction it becomes possible to give some definitions of what are really weeds under the various methods of soil-utilization.

(1.) On arable land occupied by annually sown crops any plants other than those of the crop sown can be classed as weeds. The same definition can be applied to any plants other than lucerne that occur in a lucerne crop.

(2.) On grassland, both intentionally sown and natural, plants of very low feeding-value which tend to spread rather than decrease, and occupy land that is capable of producing on an economic basis plants of higher feeding-value, can be considered weeds.

(3.) On land that is used neither for cropping nor grazing, plants that are certain to spread and limit the production from adjoining arable land or grassland, unless controlled, can be looked upon as weeds.

(4.) On unimproved ground that is later going to be taken in hand and improved, those plants any increase in which will greatly increase the difficulty and cost of improvement come under the category of weeds.

It has been mentioned that the main characteristic of a weed in farming practice is that it exercises a detrimental effect on the production from the land it occupies, or is likely to limit production in the future. So far as actually affecting production is concerned, a very great deal depends on the quantity of the plant that may be present. In most cases, no matter what the plant may be or what are its potential possibilities, the farmer does not consider the plant to be a weed unless it is in sufficient quantities to necessitate clearly some special action on his part other than customary stocking and cultivation methods.

There are, however, some important exceptions to that general rule. Certain plants throughout New Zealand are looked upon as serious weeds, irrespective of whether they are rare or plentiful. Blackberry is rightly the outstanding weed in this respect over its climatic range. There are others, again, that are rare in certain districts and widespread in others. In the districts where rare their presence is viewed as demanding the immediate application of eradication methods; but where plentiful they are tolerated, and in many cases no attempt at control is made. Californian thistle, foxglove, and ragwort are notable plants in this respect. Again, certain plants that may be abundant on waste and unoccupied land are viewed as serious weeds through the quite unnecessary fear that they will spread and cause great damage. Fennel, for instance, so abundant on certain unoccupied land, and even included in the Third Schedule of the Noxious Weeds Act, but never under any circumstances found on grazed or cultivated farm-land, is often viewed as dangerous.

There are, however, weeds which even when present in small amounts are serious, inasmuch as they cause a reduction in the saleable value of the crop, or are likely to injure live-stock or live-stock products. Dodder, watercress, and hemlock are typical examples. The first greatly lessens the value of clover-seed; the second taints milk badly; and the third, if eaten freely by stock, causes mortality. Apart from these special weeds, such as poisonous and milk-tainting plants, it is the liability of any plant undesired on the farm to increase to such an extent that the ordinary accepted method of cropping or stock-management will have to be changed or modified which really determines whether special action must be taken or not. "Dirty" is the regular term applied to farms, whether pastoral or cropping, where special methods of weed-control have to be carried out, and a "dirty" farm invariably means one the production from which is being seriously interfered with by undesirable plants.

"Dirty" farms are, unfortunately, only too common in New Zealand, and in a series of articles, of which the present one forms the introduction, it is proposed to deal with the underlying principles involved in the cleaning of such farms, and the variations in method to be adopted with relation to soil, climate, crop, and possible management conditions.

(To be continued.)

Pasteurization in Cheese-factories.—Nine additional cheese-factories have installed milk-pasteurizing plants this season. It is expected that the quantity of cheese made from pasteurized milk this season will exceed 75 per cent. of the Dominion output.

NOTES ON CONTAGIOUS ABORTION IN DAIRY HERDS.

D. A. GILL, M.R.C.V.S., D.V.S.M., Wallaceville Veterinary Laboratory.

THE season when abortions are most commonly observed among cows is now approaching, and the present is therefore a suitable time at which to remind farmers of what is known of this disease and of the means at their disposal to control it.

From the many thousands of blood-samples tested at the Wallaceville Laboratory it is safe to conclude that, with few exceptions, abortion among cows is due to the activities of Bang's bacillus—the specific microbe of contagious abortion. Farmers are all too ready to attribute the trouble to accidents, such as the animal having a fall or being chased by a dog. No doubt the wish is father to the thought, but it would be wiser to realize and face the truth. Accidental abortion is extraordinarily rare. If the calf is "slipped" following a fall, chasing, or overdriving, &c., it is almost invariably because of the ravages of the bacillus of contagious abortion in the womb—the act of abortion was pending, and the accident precipitated the event. Thus all cases of abortion must be regarded as contagious to other cows and treated accordingly.

There is no cure for this disease—a fact which must be stressed in view of the claims often made by vendors of patent medicines and cow-washes to induce farmers to buy from them. Vaccines have been used experimentally and otherwise for years, but as yet have not proved efficacious, and in some circumstances are positively dangerous. A particular form of vaccine, which at least has the merit of being harmless, inasmuch as it will not introduce the disease, is now being tested experimentally by the Department, and if results warrant it a further and much more extensive trial will be made next season. However, even should it prove useful, it will never be more than an aid to other methods of prevention and control.

All pregnant cows should be inspected frequently—not from a distance of a hundred yards or so, but closely, so that any abnormality may be discovered in its early stages. By this means a man who knows his cows can generally pick one that is going to abort in plenty of time to isolate her and avoid the main scource of infection to his other beasts—that is, soiling and infection of the pastures by the aborted fœtus, afterbirth, and subsequent discharges. A paddock should be kept for aborting stock, and they should remain in it till all discharges cease, which generally means four to six weeks. It is preferable to rig up a temporary bail in this paddock, and so avoid infecting the milking-shed; but where this cannot be done the aborted cows should be brought to the shed after the others have left, and after milking them the shed should be thoroughly flushed out and disinfected, the back-ropes and leg-ropes which have been used on them not being forgotten. The drainage from the shed should not be allowed to contaminate paddocks in which the cows are grazing. Aborted calves and membranes should be collected and burnt, and

the spot where they were found heavily dressed with quicklime. While in isolation the vaginal passage should be flushed out frequently with an antiseptic solution such as potassium permanganate and salt solution, or 1 per cent. lysol, Jeyes' fluid, Kerol, &c.

As far as is known at present, nothing further can be done during the actual abortion period. It is a common practice, when abortions have occurred, for the farmer to wash out each of the remaining pregnant cows, thinking thereby to avoid further cases. Very strong disinfectants are usually favoured. It seems highly desirable to emphasize here that such a practice is a useless waste of time. The infection, if present, is in the womb itself, which, during pregnancy, is hermetically sealed off from the vagina, so that douching cannot reach the affected tissues. It therefore cannot do good, and, moreover, by causing the unfortunate beast to strain, may easily hasten abortion if the disease is actively present.

PRECAUTIONARY MEASURES.

While the foregoing outline embraces all that can be done while the cows are aborting, there are several other factors to be reckoned with in planning to control the disease for the future.

(1.) The bull: When the causal organism of the disease was first discovered it was generally supposed that it was spread mainly through service. Subsequently it was shown experimentally that ingestion of the microbe on infected pasture, &c., was most commonly the cause, and the bull's part in transmission was pushed into the background. At present, as a result of further experimental work and the close observation of sundry outbreaks, it appears that the bull may sometimes be blamed. He may harbour the bacillus in his own genital organs, or he may carry it from cow to cow mechanically. With this in view the following practices should be observed:—

No cow that has aborted should be served till at least two months have elapsed.

No cow which shows a vaginal discharge should be served till this has been overcome.

The bull's sheath should be flushed out after each service.

In every case where a new bull is introduced into a clean herd he should be tested for the disease before use is made of him.

(2.) The calves: Nearly all cows which have aborted continue to harbour the bacillus in the udder for some years. The milk often contains it in fair quantities, and thus it reaches the calves. Hence it is present in the fæces of calves fed on such milk, and for this reason calves should always be kept in a paddock by themselves, and not allowed in contact with the adult herd or heifers of breeding age.

Up to about nine months of age calves are not affected by this microbe, though after that they enter the most susceptible period of their lives. Consequently the principal danger from milk is via the calves' fæces, and by isolating them during the milk-feeding period no risk is run.

(3.) Carriers: As has been said, a cow may harbour the organism of contagious abortion in her udder for years and yet carry her calves full time and never be suspected. Nevertheless, many such cows

expel large numbers of the germs at calving-time and the succeeding days. Thus a beast which becomes affected is a potential source of danger to clean animals unless she is regarded as an aborter, irrespective of her calving-dates, and is treated accordingly. Similarly, a bull may harbour infection (as shown by blood tests) for years, and while from the point of view of this disease he may be harmless to such cows as are affected, clean cows and heifers should not be put to him nor allowed to run with him. In many herds where the cows are extensively affected the owners' experience is that their only serious losses through abortions are caused by their heifers and first-calvers, thus demonstrating the facts here stated — that cows remain carriers and are a source of danger to clean stock where proper precautions are not taken.

A frequent and disastrous mistake often made by farmers is to sell off aborting cows and buy in new ones. The folly of this practice is evident if the facts are realized. Cows do sometimes abort two successive calves, but it is not common for them to do so. Moreover, an aborted cow is no less likely to conceive at the next breeding season than any other cow. Hence, by selling them off, valuable assets are being more or less thrown away. Moreover, such cows may be bought into a clean herd where they will introduce the disease (being carriers) and cause great anxiety and loss. On the other hand, new cows bought in to replace aborters are highly likely to abort, thus doubling the original loss and incidentally keeping the disease in an active state on the premises.

Owners who have reason to believe that abortion disease does not exist in their herds should on no account introduce new members, either males or females, without assuring themselves that these animals are also clean. Desirable as it is to avoid buying in by rearing one's own calves, there are times when to buy in is essential. In such circumstances one or two courses is open to the purchaser: he may insist on the test for abortion (blood test) being passed before purchase is made, or, if this is not feasible, he can place his purchases in strict isolation till he himself has had samples of their blood tested. If his herd is clean and his new beasts give a positive reaction he will be well advised to get rid of the latter at once.

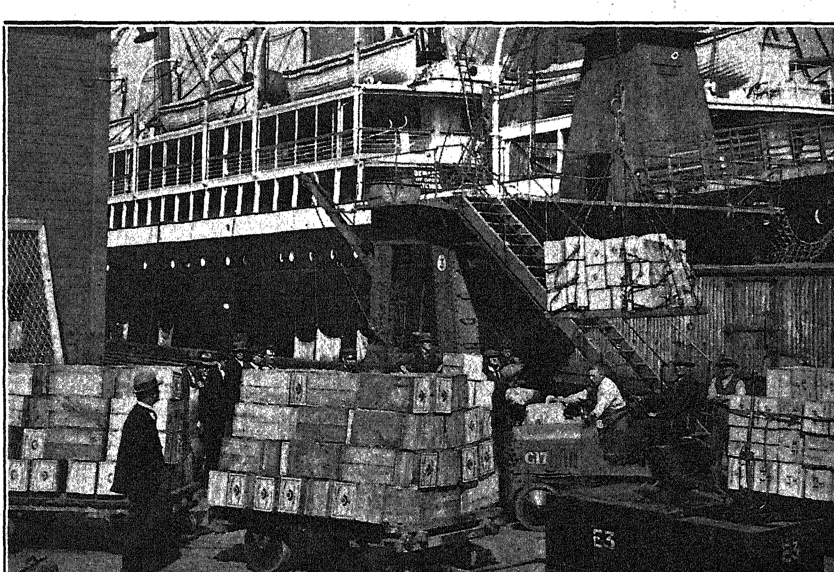
A question frequently asked by farmers who are troubled with abortion disease is, How long does the germ live on infected paddocks, &c.? It is generally considered that a period of three months is sufficient for its extermination. Actual experimental evidence that this is correct cannot be put forward, but from a knowledge of the organism's vitality and food requirements the period stated is felt to be adequate. In addition to leaving such paddocks as have been used for aborting and calving cows empty of dairy stock for three months after their purpose has been served for the season, it is a sound procedure to run a few sheep on them during that time. There is no fear of the sheep becoming affected, and they eat the paddock short, thereby greatly aiding in the cleansing process; moreover, they can be made to show a profit in place of the loss resulting from the paddocks lying idle. The three months' period being over, and the sheep disposed of, a good dressing of burnt lime will serve to make assurance doubly sure.

HOW TO SECURE AND FORWARD A BLOOD-SAMPLE.

In conclusion, a useful purpose may be served by a brief description of the simplest manner of securing a sample of blood from suspected cases. Appliances required are a pair of scissors, a sharp clean knife, a previously boiled 1 oz. bottle and cork, and a little Friar's balsam. Gather back the hair from the tip of the tail, and with the scissors clip away enough to bare the last inch of it. With the knife make a slit about ½ in. to ¾ in. long from above the tip and leading down to it. Blood will drip from this and can be caught in the bottle. Having filled the bottle at least half-way, cork it tightly, then pour a little of the balsam on the cut, pull the hair back in position, and leave the cow bailed up till bleeding ceases. A point worth noting is that having cut the tail it should be held very lightly in its normal position; a tight grip and a twisted tail will delay or stop the flow of blood.

Having satisfactorily collected the sample, it should be labelled to avoid any mistake and sent *with a covering letter* giving details of the case to the Veterinary Laboratory, Wallaceville, Wellington, where examinations are made and reports furnished without charge.

If an animal slips her calf and a blood test is required, the sample should not be forwarded till a fortnight has elapsed, as during that period the test made is not definite. During the interval between abortion and the receipt of the Laboratory report the case must, of course, be regarded as of the contagious type.



SHIPPING APPLES FOR EXPORT AT WELLINGTON.

TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1925.

W. M. SINGLETON, Director of the Dairy Division.

THE calendar year 1925 resulted in the issue of 806 certificates-of-record, as compared with 933 for the preceding twelve months — a decrease of 127 authenticated yields. It is a more or less natural expectation that the number of purebred cows entered for C.O.R. test each season will fluctuate, and not always increase from year to year. One possible explanation lies in the fact that many breeders test in advance of the rate at which their young stock is reaching the age for C.O.R. testing: that is to say, breeders entering cows for the first time will test all their eligible cows, and once tested there remains only the young stock coming on. As time goes on the number of new breeders on our lists decreases, and thus fails to offset the falling-off caused for the reason just mentioned.

So far as the statistics under review are concerned, however, the more likely explanation for the shrinkage is a decrease in the demand for purebred bulls with butterfat backing. Unlike the owner of an ordinary dairy herd used for the purpose of supplying a dairy factory, the breeder of purebred dairy cattle does not test so much for the purpose of grading up the average production of his herd as for establishing butterfat-record pedigrees, in order that he may develop a market for his surplus stock, and particularly for his bull calves. For the past two years or more purebred bulls have, on an average, brought prices that have been less encouraging to C.O.R. testing breeders. Dairy-farmers do not appear to have felt the same freedom as formerly in expenditure of money for the purchase of purebred butterfat-record bulls. This, in our opinion, is the principal reason for the falling-off in C.O.R. entries for the past year.

We feel sure, however, that this state of affairs is merely temporary, and that sooner or later the average dairyman will be compelled to realize not only the importance but the absolute necessity of paying more attention to breeding better dairy cows. This can be accomplished only by the use of a better class of bull than the average herd sire found in our dairy herds at present; but, in turn, the right bull must be a purebred selected on the basis of C.O.R. records. We regard the existing position as somewhat serious, and one which is not only an individual matter but of Dominion-wide importance. Neglect of this phase of the dairy industry must react unfavourably on our annual output of dairy-produce, and there is no need to emphasize the ultimate effect upon the pocket of the dairy-farmer as well as on the general economic position of the Dominion.

Judged on the basis of average production the 1925 figures must be considered satisfactory. Compared with the preceding year the average production for the Friesian and Ayrshire breeds has increased, while that for the Jerseys and Milking Shorthorns has decreased slightly. Climatically, however, the past year was by no means perfect from a

dairying point of view. The spring of 1924, at which period the cows whose records appear in this summary commenced their test, was somewhat dry, and continued so until about the end of December. The first three months of 1925, however, were considerably more favourable, particularly in Taranaki and the Waikato, and brought out a second growth of succulent pasture. The winter was mild generally, though very wet, but the spring of 1925 was not only again very dry in most parts but exceptionally harsh. Thus C.O.R. cows were under severe conditions at the beginning and end of their season—probably the periods when they required nature's help the most. These circumstances considered, the average production of 1925 must be accepted as more than satisfactory.

The outstanding record of the year is that of the Jersey cow Holly Oak's Annie, bred by Mr. John Hale, New Plymouth, and owned and tested by Mr. W. T. Williams, of Pukehou, Hawke's Bay. Holly Oak's Annie was granted a certificate for 1,056·49 lb. butterfat, making the third New Zealand Jersey to receive a C.O.R. on a butterfat-production exceeding 1,000 lb. Two Friesians also have this distinction.

During the year six class-leadership productions have been increased.

CERTIFICATES ISSUED.

Since the commencement of the C.O.R. system 4,832 cows have been granted first-class certificates. During 1925, certificates were issued on first performance for 658 cows, and on second or subsequent performance for 148 cows, making a total of 806 certificates issued during the year. Details are given in the following table, figures for the preceding year having been added for purposes of comparison :—

Breed.	1925.			1924.		
	Ordinary.	Repeat.	Total.	Ordinary.	Repeat.	Total.
Jersey	501	98	599	583	91	674
Friesian	107	40	147	148	43	191
Milking Shorthorn ..	24	6	30	32	6	38
Ayrshire	20	3	23	23	1	24
Red Poll	6	1	7	6	..	6
Totals ..	658	148	806	792	141	933

Second-class Certificates.—During 1925, second-class certificates were issued for twenty-two Jerseys, twelve Friesians, and two Milking Shorthorns. Obviously, therefore, the number of second-class certificates is a negligible proportion of the total certificates issued during the year. Grouping the cows of each particular breed into one class, the twenty-two second-class Jersey records averaged 471·29 lb. butterfat, and the twelve Friesians 519·37 lb. Of the two second-class certificates for Milking Shorthorns, one was for Matangi Quality 4th (now dead), whose butterfat-yield reached the high figure of 978·47 lb.

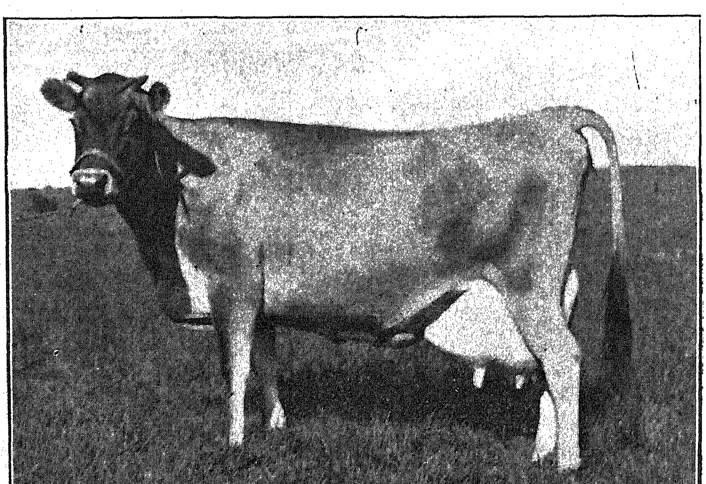
JERSEYS.

Class-leaders.

The list of Jersey class-leaders shows two changes for the year under review. The junior two-year-old Keston Flower, owned and tested by Mr. G. E. Yelchich, displaces Mr. F. J. Saxby's Alfalfa Pansy. The new leader, with a C.O.R. for 694·28 lb. butterfat, adds some 4 lb. to the performance of the previous holder of the position. The other change, which falls in the mature class, is notable on account of the fact that the previous record, made by Mr. A. Christie's Vivandiere, was no less than 1,036·09 lb. butterfat. Vivandiere yields her place to Mr. W. T. Williams's Holly Oak's Annie, with 1,056·49 lb., which is the highest C.O.R. Jersey record to date for New Zealand.

The class-leaders at the end of 1925 are as follows:—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old. Keston Flower ..	G. E. Yelchich, Waiuku	1 359	240·5	365	11,472·2	694·28
Senior Two-year-old. Marshland's Stylish Princess	W. J. Chynoweth, Hamilton	2 353	275·8	365	9,927·7	715·75
Three-year-old. Loo's Queen ..	A. Christie, Tanekaha	3 332	310·2	365	13,422·3	797·32
Four-year-old. St. Lambert's Bell ..	A. J. Smith, Cardiff ..	4 283	341·8	365	14,423·1	780·32
Mature. Holly Oak's Annie ..	W. T. Williams, Pukehou	5 9	350·0	365	18,522·7	1,056·49



HOLLY OAK'S ANNIE.

Leader of Jersey mature class, and New Zealand champion of the breed.

Jersey Class-averages.

Of the five classes into which the Jersey breed is subdivided, only two, the mature and the four-year-old, show an increase over the preceding year. A total of 599 cows is represented, as against 674 for the previous year. It will be noticed that the majority of the cows fall into the junior two-year-old class; the mature class also containing a large proportion of the total.

The class-averages for 1925 and 1924 are given in the following table:—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1925.		lb.	lb.
Junior two-year-old ..	237	344	7,132·1	395·71
Senior two-year-old ..	59	347	8,154·6	457·64
Three-year-old	79	346	8,634·7	480·85
Four-year old	47	352	9,484·4	523·82
Mature	177	345	9,501·6	516·94
	1924.			
Junior two-year-old ..	253	350	7,417·0	409·80
Senior two-year-old ..	75	353	8,204·1	459·59
Three-year-old	90	348	9,026·9	498·42
Four-year-old	57	348	9,093·0	506·88
Mature	199	347	9,647·7	521·52

The following table shows the averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. testing system in 1912:—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Junior two-year-old ..	1,384	345	6,889·8	383·94
Senior two-year-old ..	393	344	7,617·8	427·49
Three-year-old	575	342	8,246·4	458·23
Four-year-old	355	344	8,704·1	482·99
Mature	955	345	9,223·5	503·49
All	3,662	344	7,965·4	441·06

Jersey C.O.R. Bulls.

Up to the end of 1925 some 213 Jersey bulls have qualified for the C.O.R. bull list; thirty-two names were added during the year under review, and ninety-eight are eligible for inclusion in this summary. The bulls marked † are champion butterfat bulls: that is to say, they qualify for the New Zealand Jersey Cattle Breeders' Association's special class for bulls with five or more C.O.R. daughters, each

daughter at least doubling its butterfat requirement for certificate, and each from a different dam. There are now nine champion butterfat bulls, and it will be noted that seven are eligible for inclusion in the following list :—

Key to numbers opposite names: First number—first-class C.O.R. daughters; second—ditto, qualified on subsequent performances; third—second-class C.O.R. daughters; fourth—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1925.

Grannie's Knight†	45	8	3	56
Sultan's Disdain	42	11	5	58
Majesty's Fox	32	6	0	38
Noble Twylish	29	4	0	33
Fancy's Lord Twylish	21	9	0	30
Roberts	21	0	0	21
Viola's Golden Laddie	20	6	1	27
Te Rapa Lad	19	1	0	20
Proud Fox	17	6	1	24
Neathead's Majesty	17	5	2	24
Mona's Ally	17	1	0	18
V.C.†	16	2	0	18
Belvedere Bilberry's Last	15	1	0	16
The General	14	6	1	21
Sunflower's Perseus†	14	4	0	18
Lady's Duke	14	1	1	16
Sweet Fox of Collingwood	14	1	0	15
Meadowvale Conqueror	13	2	0	15
Rose's Attraction's Fox†	13	0	1	14
Hawkesbury Emperor	12	4	0	16
Petune's Noble	12	1	3	16
Molina's General	12	3	0	15
Bilberry's Twylish†	12	1	2	15
Soumise Majesty	12	1	0	13
Miro Meadows Star	12	0	0	12
Rainbow's King	11	2	1	14
Twylish Hope	11	2	0	13
Pecuarius	11	0	0	11
Bridge View's Magnet	11	0	0	11
Maid's General	10	1	1	12
Noble Sultan	10	1	0	11
Waipiko Masterpiece†	9	2	0	11
Eileen's Fox	9	2	0	11
Maori Captain	9	1	0	10
Maid's Noble General	9	1	0	10
Owler of Puketapu†	9	0	1	10
Genoa Nelson Chase	8	2	0	10
Soumise Prince*	8	1	0	9
Butterman Lad	8	1	0	9
Golden Fox	8	0	1	9
Waipiko Josiah	8	0	0	8
Exile of Cloverland*	7	0	1	8
Meadowvale General Daisy*	7	0	1	8
Distinction's Twylish*	7	0	1	8
Grannie's Campanile Sultan	7	1	0	8
Reid Park's Lord	7	0	0	7
Signor	7	0	0	7
Floss's Starlight	6	2	1	9
Brentwood's Fancy's Swan*	6	0	2	8
Achievement of Willow Bank	6	1	1	8
Perfection's King	6	2	0	8
Avoca's Protection	6	1	0	7
Bright Knight	6	0	1	7
Waipiko Leonard*	6	0	0	6
Brampton Merry Boy*	6	0	0	6
Beachlands Admiral	6	0	0	6
Majesty's Squire	6	0	0	6
Miro Meadows Quickshine	6	0	0	6
Rita's Molina	6	0	0	6
Golden Swan's Lad	6	0	0	6
Hawkesbury Majestic	6	0	0	6
Juno's Laddie	6	0	0	6
Una's Nobility	6	0	0	6
Woodstock's Lord Raleigh	6	0	0	6
Fox's Double*	6	0	0	6
Defender of Meadowvale	5	2	0	7
Nestor of Willowbank	5	2	0	7
Rimu	5	2	0	7
K. See 7th*	5	0	2	7
Prince Enid	5	1	1	7
Belvedere Bilberry's Bob	5	1	0	6
Miro Meadows Dick	5	1	0	6
Woodstock's Golden Lad*	5	0	1	6
Darkie's Pride*	5	0	0	5
Miro Meadows Glaxo*	5	0	0	5
Belvedere Silver Trumpeter*	5	0	0	5
Aster's Golden Lad*	5	0	0	5
Dainty's Enigma's K.C.*	5	0	0	5
Rewarder*	5	0	0	5
Ravenswood Model*	5	0	0	5
Lord Maitland	5	0	0	5
Molly's Lad	5	0	0	5
Majestic Duke	5	0	0	5
Miro Meadows Hope*	5	0	0	5
Flora's Good Cheer*	4	1	0	5
Laurel's Orange Lad*	4	1	0	5
Grafton Pepper's Boy	4	0	0	4
Anzac*	4	0	0	4
Matokitoki's Lad*	4	0	0	4
Brentwood Hero*	4	0	0	4
Bluebeard of Puketapu*	4	0	0	4
Caius*	4	0	0	4
Eaton Lord Charm*	4	0	0	4
Queen's Glory Lad*	4	0	0	4
Bright Sultan*	4	0	0	4
Capsicum's Maple*	4	0	0	4
Molina's Primrose*	4	0	0	4
Rozel's Boy*	4	0	0	4

FRIESIANS.

Class-leaders.

The Friesian class-leaders remain as at the end of 1924. Despite this fact, however, some noteworthy performances have been authenticated during the year, and four cows have been granted certificates on yields exceeding 900 lb. butterfat. The highest of these four certificates is one for 950·90 lb., made by Mr. T. H. Richards's Monavale Queen Bess in the mature class. It may be recalled that this cow already has two certificates to her credit, on each of which she remains a class-leader. As shown in the table, these certificates were gained in the junior two-year-old and junior three-year-old class respectively.

The list is here reprinted :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Monavale Queen Bess	T. H. Richards, Cardiff	2 16	242·1	365	20,501·1	740·50
Senior Two-year-old.						
Netherland Princess 4th	John Donald, Westmere	2 341	274·6	365	19,621·6	805·77
Junior Three-year-old.						
Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
Senior Three-year-old.						
Manor Beets Daughter 2nd of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·9	863·51
Junior Four-year-old.						
Westmere Princess Pietertje	John Donald, Westmere	4 156	329·1	365	24,199·0	939·78
Senior Four-year-old.						
Bainfield 27th ..	C. H. Potter, Pukerau	4 351	348·6	365	23,203·3	910·74
Mature.						
Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·5	1,145·24

Friesian Class-averages.

Four classes out of the seven into which the Friesian breed is subdivided show increases for 1925 as compared with 1924. The classes which improved their average production were the junior two-year-olds, the junior and senior four-year-olds, and the mature. As the 1924 averages were, on the whole, of a fairly high standard, this increase must be considered very satisfactory. In total numbers, however, there has been a decrease, 147 certificates having been awarded during the year as compared with 191 for the preceding twelvemonth.

The figures for 1925 and 1924 are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1925.		lb.	lb.
Junior two-year-old ..	44	349	12,094·8	428·09
Senior two-year-old ..	13	357	12,565·3	442·42
Junior three-year-old ..	13	319	12,048·5	436·60
Senior three-year-old ..	11	328	13,358·8	492·47
Junior four-year-old ..	5	336	15,458·6	548·46
Senior four-year-old ..	8	352	16,301·8	581·85
Mature	53	332	16,559·3	573·82
	1924.			
Junior two-year-old ..	51	355	11,516·8	400·04
Senior two-year-old ..	31	352	13,286·0	472·86
Junior three-year-old ..	24	336	13,637·3	471·33
Senior three-year-old ..	11	342	14,502·7	499·93
Junior four-year-old ..	11	347	15,293·2	541·69
Senior four-year-old ..	7	332	15,462·1	501·42
Mature	56	340	16,516·5	562·54

The following table shows the averages, class by class, of all certificates issued for Friesian cows since the commencement of the C.O.R. testing in 1912 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Junior two-year-old ..	373	347	11,203·9	398·06
Senior two-year-old ..	179	346	12,125·4	429·61
Junior three-year-old ..	137	340	13,087·0	459·83
Senior three-year-old ..	135	339	13,611·2	482·80
Junior four-year-old ..	85	342	14,392·3	508·00
Senior four-year-old ..	82	347	15,590·1	541·09
Mature	388	339	15,367·1	537·10
All	1,379	343	13,375·0	470·99

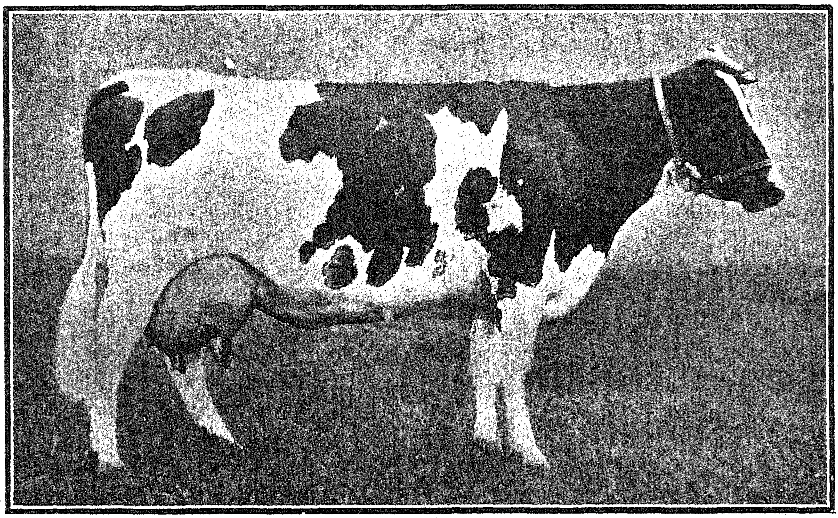
Friesian C.O.R. Bulls.

The Friesian C.O.R. bulls have now reached a total of eighty-two, seven new names having been added during the year. Of the seventy-five bulls which had qualified to the end of the preceding year (1924) twelve have increased the number of their C.O.R. daughters, thus making nineteen names eligible for inclusion in the present summary.

The list is as follows :—

Key to numbers opposite names: First number—first-class C.O.R. daughters; second—ditto, qualified on subsequent performances; third—second-class C.O.R. daughters; fourth—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1925.

King Segis Wild Rose Homestead ..	22	7	0	29
Cliffside Laddie ..	21	5	0	26
Dominion Woodcrest Piebe Mercedes ..	13	2	0	15
Bainfield Dutchman ..	12	4	2	18
Rosevale Korndyke Sylvia Posch ..	11	9	1	21
Rosevale King Sylvia..	11	3	3	17
Marquis Segis Colantha	9	2	1	12
Mutual Mercedes Pietertje	9	1	0	10
Black and White King of Ashlynn ..	7	0	1	8
King Pontiac Korndyke*	6	1	0	7
Woodcrest Johanna Pontiac	6	1	0	7
Dominion Woodcrest Beets*	6	0	0	6
Marquis Piebe de Kol	6	0	0	6
King Segis of Friesland Park	5	1	1	7
Dominion Paul Colantha*	5	0	0	5
Pietje Johanna de Kol*	5	0	0	5
Woodcrest Pontiac Alcartra*	4	1	1	6
Brookland's Waihi Segis*	4	1	0	5
Rosevale Plus Triumph*	4	1	0	5



ALCARTRA CLOTHILDE PIETJE.

Leader of Friesian mature class, and New Zealand champion of the breed.

MILKING SHORTHORNS.

Class-leaders.

With the exception of the senior two-year-old class, the class-leaders for the Milking Shorthorn breed remain as at the end of 1924. In the senior two-year-olds Mr. G. N. Bell's Birkland Dainty, with 459·98 lb. butterfat, yields her place to Mereside Gem, owned by Mr. W. Bowis, Doyleston. The new leader is credited with 461·52 lb. fat, thus increasing the record for this class by less than 2 lb. of butterfat.

The Milking Shorthorn class-leadership list is now as follows :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old.						
Mereside Gem ..	W. Bowis, Doyleston	2 350	275·5	365	11,286·3	461·52
Junior Three-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old.						
Matangi Nancy 2nd	Ranstead Bros., Matangi	4 3	313·8	365	15,591·6	608·28
Senior Four-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	4 355	349·0	340	11,670·3	644·90
Mature.						
Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

Milking Shorthorn Class-averages.

The number of certificates issued to cows of this breed in 1925 shows a decrease of eight over the previous year. This must be accepted as considerable when it is borne in mind that only thirty certificates were issued during the year under review and thirty-eight in 1924. Seeing that the classes are small, three having only one representative each, a comparison is really of little value. We therefore leave the figures to speak for themselves.

The class-averages for 1925, together with those for the preceding year, are as follows :—

Class.	Number of Cows.	Average Yield for Season. Days in Milk.	Milk.	Fat.
	1925.		lb.	lb.
Junior two-year-old ..	7	345	8,943·7	367·18
Senior two-year-old ..	1	365	11,286·3	461·52
Junior three-year-old ..	1	305	11,790·5	498·93
Senior three-year-old ..	2	330	10,344·5	463·93
Junior four-year-old ..	3	345	9,598·5	423·88
Senior four-year-old ..	1	360	12,081·1	498·11
Mature	15	335	13,380·3	541·55
	1924.			
Junior two-year-old ..	6	344	8,372·0	337·77
Senior two-year-old ..	3	350	7,478·8	302·35
Junior three-year-old ..	3	354	12,722·7	523·81
Senior three-year-old ..	4	352	12,133·4	508·36
Junior four-year-old ..	2	365	11,179·3	435·16
Senior four-year-old ..	4	349	12,846·1	574·19
Mature	16	341	13,310·1	536·50

The following table shows the averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914:—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Junior two-year-old ..	37	352	8,560·4	345·61
Senior two-year-old ..	22	345	8,309·2	332·07
Junior three-year-old ..	18	335	9,628·4	382·36
Senior three-year-old ..	16	343	10,645·2	449·35
Junior four-year-old ..	15	348	10,524·9	423·57
Senior four-year-old ..	16	346	11,744·8	470·87
Mature	207	341	11,468·6	457·45
All	331	343	10,764·3	431·25

GLENTHORPE LADY.

Leader of Milking Shorthorn mature class, and New Zealand champion of the breed.

Milking Shorthorn C.O.R. Bulls.

The C.O.R. bulls of the Milking Shorthorn breed now total five, the name of Matangi Pride having been added during the year under review. Matangi Pride has seven C.O.R. daughters to his credit, all first-class certificates gained in 1925. Only one of the bulls previously qualified failed to add to his list of C.O.R. daughters since our last annual review. Details of those bulls eligible for mention in this summary are as follows:—

Key to numbers opposite names: First number—First-class C.O.R. daughters; second—ditto, qualified on subsequent performances; third—second-class C.O.R. daughters; fourth—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1925.

Dominion Esau of Ruakura	14	2	2	18
Dilworth Baronet ..	6	1	1	8
Matangi Pride ..	7	0	0	7
Marlborough of Darbalara	5	0	0	5

AYRSHIRES.

Class-leaders.

The year under review brought two changes to the class-leadership figures of the Ayrshire breed. In the two-year-old class Mr. W. Hall's Dimple of Edendale, with 529·46 lb. butterfat, gives way to Fair Maid of Greenbank, owned and tested by Mr. W. Moore, Homebush. The new leader has increased the maximum yield for a cow of this class by no less than 144 lb. fat. The other change occurs in the mature class. The previous leader, Ivanhoe Fillpail, owned and tested by Mr. A. M. Weir, Menzies Ferry, held the leadership on a C.O.R. for 646·31 lb. fat. Glencairn Brownie goes to the head of this class with 728·05 lb. fat, an increase of some 82 lb. Glencairn Brownie, who is now the New Zealand champion for the Ayrshire breed, was owned and tested by Mr. A. Montgomerie, of Kauwhata.

The present Ayrshire class-leaders are as follows:—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
Two-year-old.						
Fair Maid of Greenbank	W. Moore, Homebush	2 27	243·2	365	12,281·3	673·56
Three-year-old.						
Ivanhoe Stylish Daisy	A. M. Weir, Menzies Ferry	3 312	308·2	365	12,334·2	574·09
Four-year-old.						
Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature.						
Glencairn Brownie ..	A. Montgomerie, Kauwhata	8 360	350·0	365	15,579·4	728·05

Ayrshire Class-averages.

Twenty-three certificates were issued to Ayrshires in 1925, the same number as in 1924. Many good Ayrshire yields were recorded during the year, and as a result the class-averages in three classes out of the four have considerably increased. They now stand for the two years as follows:—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1925.		lb.	lb.
Two-year-old	5	365	12,298·0	512·54
Three-year-old	2	341	9,162·6	354·84
Four-year-old	3	345	14,043·4	549·24
Mature	13	348	12,743·0	529·69
	1924.			
Two-year-old	6	354	7,025·0	297·01
Three-year-old	3	363	11,932·4	519·03
Four-year-old	3	355	11,603·6	471·87
Mature	12	353	11,442·2	466·93

The following table shows the averages, class by class, of all certificates issued to Ayrshire cows since the commencement of the C.O.R. testing in 1912 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Two-year-old	40	343	8,943·5	364·44
Three-year-old	26	348	9,887·1	401·97
Four-year-old	19	348	11,309·2	464·02
Mature	75	347	11,633·0	482·03
All	160	346	10,638·4	437·48

IVANHOE FANCY.

Leader of Ayrshire four-year-old class.

Ayrshire C.O.R. Bulls.

The number of Ayrshire bulls which have qualified for the C.O.R. list remains as at the close of 1925, the total being six. Of these only one, Hindsward Jimmie of Townhead, added to his previous total, his number of C.O.R. daughters having been increased by five. The figures for this bull now stand at eleven daughters with first-class certificates, and one of these with a certificate on a second performance.

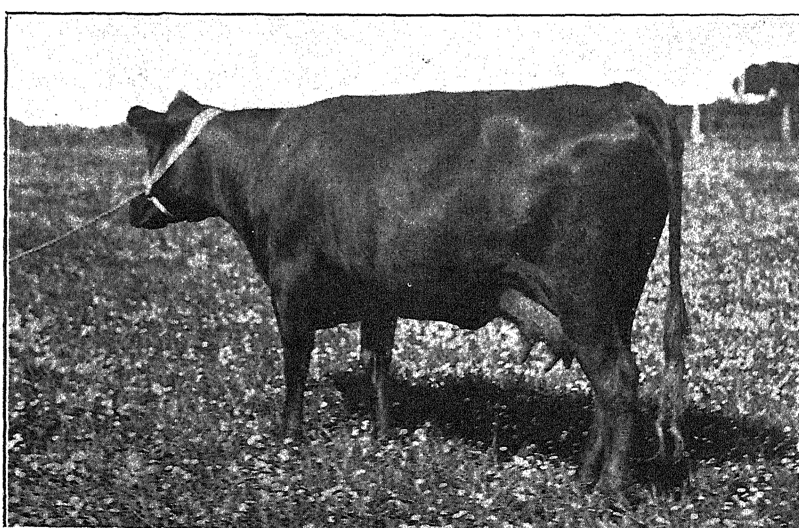
RED POLLS.

Class-leaders.

One change of class-leadership has to be recorded for the Red Poll breed. Dominion Sylphide, with 430·74 lb. butterfat, owned and tested by the Central Development Farm, Weraroa, is replaced by Wayward 6th B No. 1—511·42 lb. butterfat—owned and tested by Mr. G. S. Young, West Plains, Southland. The previous leader commenced her test at the age of 1 year 339 days, and the commencing age of the new leader was 2 years 188 days.

The highest yields for each class are shown in the following table:—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
Two-year-old.						
Wayward 6th B No 1	G. S. Young, West Plains	2 188	259·3	365	11,228·0	511·42
Three-year-old.						
Dominion Gold Top..	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old.						
Dominion Opticia ..	Central Development Farm, Weraroa	4 343	347·8	365	9,958·50	441·27
Mature.						
Dominion Sylph ..	Central Development Farm, Weraroa	5 4	350·0	365	11,009·00	505·84



WAYWARD 6TH B NO. 1.

Leader of Red Poll two-year-old class, and New Zealand champion of the breed.

Red Poll Class-averages.

Seven Red Polls gained certificates of record in 1925, five of these being owned and tested by the Central Development Farm, Weraroa,

and the remaining two by Mr. G. S. Young, West Plains, Southland. Six of the Red Polls certificated last year were in the junior two-year-old class, and the seventh commenced test as a senior three-year-old.

The following table shows the position for 1925 :—

Class.	Number of Cows.	Days in Milk.	Milk.	Fat.
			lb.	lb.
Two-year-old	6	346	7,938·9	365·97
Mature	1	333	9,185·6	410·39

The following table shows the averages, class by class, of all certificates issued to Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Two-year-old	22	342	7,599·6	345·53
Three-year-old	11	343	8,066·4	351·85
Four-year-old	4	336	8,763·9	381·66
Mature	10	332	9,919·5	436·23
All	47	340	8,301·5	369·38

Red Poll C.O.R. Bulls.

In the present summary Red Poll C.O.R. bulls appear for the first time. Owing to the small number of Red Poll cows entered for C.O.R. test, this list was previously not prepared. It is now found that three bulls are eligible for inclusion—namely, Force Majeure, 13—1—0—14; Belligerent, 6—2—0—8; and Aviator, 5—0—0—5. The twenty-four C.O.R. daughters included under these three names were all owned and tested by the Central Development Farm, Weraroa.

EXPORT OF PUREBRED DAIRY CATTLE.

The calendar year 1925 showed a falling-off in the number and total value of purebred dairy cattle exported from the Dominion. Some ninety-three animals were sent out of the country, forty-nine of these going to Australia, twenty-one to Argentine, nineteen to Fiji, three to South Africa, and one to Tonga. The total declared value of these beasts was about £5,200. The previous year's figures were 178 animals, valued at some £8,635.

We desire to thank once again the secretaries of those breeders' associations co-operating with the Dairy Division in connection with the C.O.R. testing system for the cordial assistance rendered during the year—namely, Messrs. W. M. Tapp (Jersey), J. P. Kalaugher (Friesian), W. Hunter (Milking Shorthorn), R. H. Spencer (Ayrshire), and N. Inder (Red Poll).

OAT-SMUT.

SURVEY AND EXPERIMENTAL WORK, SEASON 1925-26.

J. C. NEILL, Field Mycologist, Biological Laboratory, Wellington.

OAT-SMUT has this year destroyed 600,000 bushels of oats in Canterbury, Otago, and Southland—a direct loss of £135,000. This loss may be almost wholly prevented by simple treatment of the seed-grain at a cost of less than a penny per bushel. The evidence in support of these statements is here presented.

OAT-SMUT.

The spore masses are held in place by the external glumes.

[*Photo by H. Drake.*

INCIDENCE OF THE DISEASE.

In January and February of this year the writer, in collaboration with Messrs. F. W. Greenwood, F. E. Ward, R. B. Tennent, and R. McGillivray, Instructors in Agriculture for Marlborough, Canterbury, and Otago and Southland respectively, made a flying survey of the cereal diseases present in the South Island. A few crops taken at random in each locality were carefully examined, and the percentage of disease present estimated on a series of plant counts.

The results obtained in regard to oat-smut are here given in tabular form. The loss due to smut is computed on an acreage basis. Thus a crop of 100 acres showing 10 per cent. of smut is listed as losing 10 acres, which, at 38·7 bushels per acre (the Dominion average yield for 1924–25), represents 387 bushels, valued at 4s. 6d. per bushel. In calculating the aggregate loss in yield only crops showing smut to the extent of 1 per cent. or over are here considered, though in the aggregate the loss in the many crops showing from a trace to 1 per cent. must be considerable. Nor is any account taken of the deterioration in the quality of the grain or chaff caused by the presence of the smut. It is assumed in calculating each aggregate provincial loss that the crops examined represented a fair sample of the whole.

Table 1.—Number and Condition of Crops examined.

Province.	Examined.	Clean.	Smutted.		
			Trace to 1 per Cent.	1 per Cent. to 20 per Cent.	Above 20 per Cent.
Marlborough ..	12	10	2	..	..
Canterbury ..	35	18	12	5	..
Otago	100	12	41	33	14
Southland	110	11	47	42	10

Table 2.—Estimated Losses from Oat-smut.

Province.	Crops examined.			Statistical Estimate.		
	Area.	Actual Loss.		Provincial Area in Oats, 1925–26.	Loss.	
					Quantity.	Value.
	Acres.	Acres.	Bushels.	Acres.	Bushels.	£
Marlborough ..	398	..	..	15,000	..	..
Canterbury ..	1,175	13·8	534	187,000	84,915	19,100
Otago	5,119	528·0	20,434	82,000	326,938	73,600
Southland ..	2,362	157·0	6,076	71,000	182,277	41,000
Totals ..	9,054	698·8	27,044	355,000	594,130	133,700

PREVENTIVE TREATMENT.

Smut in oats is wholly due to sowing infected seed. In most parts of New Zealand it is safe to say that unless the seed is disinfected smut is certain to appear in the crop. At the present state of our knowledge the most satisfactory means of disinfection is by means of the formalin steep. This has been the experience of many farmers, and is confirmed by the experimental results given below. If correctly applied it apparently causes little or no damage to the seed-grain, and it has given more complete control of the smut than any of the other chemical methods tried.

A simple and effective method of applying the treatment is as follows: In a tin bath, wooden or concrete trough, or other receptacle mix the formalin with water in the proportion of 1 pint of formalin to 40 gallons of water. Do not guess, but measure the quantities accurately, for on their correctness largely depends the success of the treatment. Put half of each sack of seed oats into another sack, so that the sacks for treatment are not more than half full. Immerse the sacks and grain below the surface of the formalin solution for exactly ten minutes, moving the sack and grain about several times while under. At the end of ten minutes remove the sack from the solution. A good method for this is by means of a block and tackle rigged over the trough, by which the sack can be lifted and left for a while suspended over and draining back into the trough. The sack is then thrown on the ground and the grain flattened out to an even layer within the sack. If the operation is performed in the evening the grain will be fit for sowing the next morning. Do not empty the

grain into other sacks unless they have been previously disinfected; it is also a wise precaution before sowing to wash out the drill with formalin solution made up in the proportion of one part of formalin to ten parts of water. A pint bottle of formalin costs about 2s. 9d., and it will make enough solution to treat about 50 bushels of seed oats. Dipping may be continued in the same solution until the level is too low to cover the sacks, when fresh solution should be added in the same proportions—1 pint of formalin to 40 gallons of water.

GENERAL DISCUSSION.

The chief disadvantage of the formalin steep is that, while it reduces to small proportions the smut present in the crop even when grown from heavily infected seed, it does not eliminate the smut altogether. For this reason the seed must be treated every year, and probably there are enough careless farmers in any district who, by failing to treat, ensure that losses from smut shall continue. There are certain isolated oat-growing areas in New Zealand where, though the growers do not treat, no smut develops except in an occasional crop grown from imported seed. This freedom from the disease is not by reason of soil or climatic condition, but solely because the smut fungus is not present in the area. If a method of seed-disinfection can be evolved that will completely disinfect there is no reason why, by co-operative effort, the other oat-growing districts may not also get rid of both the disease and of the yearly necessity to steep.

It is with this idea in mind that the experiments detailed below have this season been carried out. It will be seen on examination of the tabulated results that the hot-water method is the only one which completely disinfected the seed. Unfortunately, certain at present inexplicable features of these results make further experiments with this method necessary before it can be practically applied.

SUMMARY OF EXPERIMENTAL RESULTS (SEE TABLE 3).

(1.) The mercuro-phenol treatments—Uspulun, Germisan, Semesan, Corona 640 steeps, and Semesan dust — all failed to more than partially control oat-smut, but all produced more plants and heads per seed sown than the untreated controls. This applies also to Clarke's Wheat Protector.

(2.) Copper-carbonate dusts reduced infection to about 5 per cent., as against from 25 per cent. to 40 per cent. in the controls. It also produced more plants and heads per seed sown. Colloidal copper-dust acted similarly, though not so effectively as the copper carbonate.

(3.) Copper sulphate (bluestone) reduced the germinative energy, and, on the average, produced fewer plants and heads per seed sown. It reduced the smut to about 4 per cent.

(4.) Formalin, 1–320 (= 1 pint to 40 gallons), while it reduced the smut to from 0·3 per cent. to 4 per cent., as against from 20 per cent. to 50 per cent. in the adjacent controls, showed little or no damage to the seed. At the strength of 1–480 (= 1 pint to 60 gallons) there was an improvement over controls in plants and heads produced, but the smut rose to from 4 per cent. to 9 per cent. The presoak

Table 3.—Experiments on Oat-smuts at Ashburton Experimental Farm, Season 1925–26.

Dun.

Treatment.	Percentage Germination. In Laboratory.	In Field. First Count. %	In Field. First Count. PE ±	In Field. Mature Plants.	Plants. Total.	Plants. Smutted. *Ustilago levis.*	Plants. Smutted. *Ustilago Avenae.*	Plants. Percentage smutted.	Heads. Total.	Heads. Smutted.	Heads. Percentage smutted.
Control ..	85.5	67.0	2.2	61.0	122	15	10	20.5	427	83	19.5
pper carbonate No. 1	97.5	81.7	1.36	78.5	314	27	6	10.5	933	88	9.4
Control ..	85.5	65.5	1.96	62.5	125	32	7	31.2	461	127	27.5
pper carbonate No. 2	97.5	78.7	1.03	77.5	310	15	4	6.1	1,108	53	4.7
Control ..	85.5	69.0	1.72	67.0	134	30	8	28.3	484	125	25.9
lloidal copper ..	97.5	75.0	1.53	75.5	302	15	13	9.2	985	82	8.3
Control ..	85.5	68.0	1.84	66.0	132	28	7	26.5	493	101	20.5
mesan dust ..	93.0	77.0	1.33	74.2	297	37	22	19.8	963	157	16.3
Control ..	85.5	65.5	1.74	59.0	118	18	10	23.7	440	79	18.0
mesan steep ..	93.0	77.5	1.48	73.5	294	31	11	14.3	1,047	110	10.5
Control ..	85.5	59.5	1.92	66.5	133	37	11	36.2	460	136	29.5
rona 640 steep ..	90.0	76.3	1.74	72.0	288	66	39	36.4	1,057	311	31.4
Control ..	85.5	69.5	1.55	64.0	128	35	7	32.8	420	116	27.6
pulun	86.0	81.0	1.50	77.7	311	25	14	12.5	1,098	107	9.7
Control ..	85.5	67.5	1.48	66.0	132	34	9	32.6	447	123	27.5
rmisan	84.5	79.3	1.38	82.5	330	16	10	7.9	1,083	78	7.2
Control ..	85.5	67.5	1.42	68.5	137	33	5	27.7	443	95	21.5
ırke's Wheat Protector	90.0	71.0	1.62	69.7	279	25	4	10.4	908	74	8.1
Control ..	85.5	69.5	1.52	68.5	137	21	5	19.0	437	67	15.4
uestone 1% ..	..	..	..	..	..	..	..	..	..	..	..
Control ..	..	..	..	..	..	..	..	..	..	..	..
uestone 2% ..	75.5	53.5	1.67	61.5	246	6	2	3.2	705	31	4.4
Control ..	85.5	67.0	1.49	61.0	122	22	3	20.5	350	68	19.5
rmalin 1–320 ..	87.5	69.3	1.79	67.7	271	9	0	3.3	778	23	3.0
Control ..	85.5	67.5	..	64.5	129	23	6	22.4	325	64	19.7
rmalin 1–480 ..	..	..	..	..	..	..	..	..	..	..	..
Control ..	..	..	..	..	..	..	..	..	..	..	..
rmalin 1–320 presoak	..	..	..	..	..	..	..	..	..	..	..
Control ..	..	..	..	..	..	..	..	..	..	..	..

Garton (Invercargill).

Treatment.	Percentage Germination. In Laboratory.	In Field. First Count. %	In Field. First Count. PE ±	In Field. Mature Plants.	Plants. Total.	Plants. Smutted. *Ustilago levis.*	Plants. Smutted. *Ustilago Avenae.*	Plants. Percentage smutted.	Heads. Total.	Heads. Smutted.	Heads. Percentage smutted.
Control ..	97.2	74.5	1.99	69.5	139	59	1	43.2	323	122	37.9
pper carbonate No. 1	97.0	81.7	1.47	79.5	318	14	2	5.1	791	39	4.9
Control ..	97.2	83.5	1.84	80.0	160	71	2	45.0	388	155	40.0
pper carbonate No. 2	96.5	77.0	1.75	74.7	299	15	2	5.7	743	33	4.4
Control ..	97.2	73.0	1.75	63.5	129	99	1	54.1	321	141	43.8
lloidal copper ..	97.0	76.3	2.10	73.2	293	26	1	9.2	750	54	7.2
Control ..	97.2	78.0	2.11	69.0	138	65	3	49.3	342	149	43.5
mesan dust ..	98.0	81.7	1.81	76.2	305	92	2	30.8	793	192	24.3
Control ..	97.2	75.5	2.08	64.0	128	72	0	56.2	308	151	49.0
mesan steep ..	98.0	81.0	1.48	78.2	313	80	2	26.0	802	179	22.2
Control ..	97.2	75.5	1.72	67.0	134	76	5	60.4	330	176	53.3
rona 640 steep ..	97.0	84.7	1.16	81.0	324	86	5	28.1	751	176	23.4
Control ..	97.2	69.5	1.88	61.0	122	65	2	55.0	292	143	48.8
pulun	97.5	82.7	2.09	78.0	312	68	0	21.8	763	129	16.8
Control ..	97.2	71.5	1.67	64.0	128	68	2	54.8	315	152	48.2
rmisan	98.5	80.5	1.33	77.7	311	21	0	6.8	765	41	5.3
Control ..	97.2	82.5	1.51	73.5	147	84	1	57.8	364	181	49.7
ırke's Wheat Protector	95.5	81.3	2.01	77.5	310	62	2	20.6	754	122	16.2
Control ..	97.2	75.5	1.31	71.0	142	67	2	48.6	362	151	41.8
uestone 1% ..	94.0	75.0	1.86	71.5	286	13	1	4.9	666	24	3.6
Control ..	97.2	77.5	1.41	72.5	145	64	2	45.5	361	137	37.9
uestone 2% ..	92.0	63.5	1.59	61.7	247	17	0	6.9	548	25	4.6
Control ..	97.2	76.0	2.12	68.0	136	69	0	50.8	350	154	44.0
rmalin 1–320 ..	94.0	71.0	0.88	64.0	256	1	0	0.4	666	2	0.3
Control ..	97.2	65.0	1.66	62.5	125	73	0	58.4	282	159	56.4
rmalin 1–480 ..	97.5	78.5	1.26	72.2	289	16	1	5.9	743	28	3.8
Control ..	97.2	72.7	1.64	66.0	132	65	4	52.3	338	151	44.7
rmalin 1–320 presoak	95.0	78.5	2.00	75.0	300	4	1	1.7	737	7	1.0
Control ..	97.2	68.5	2.62	64.7	259	108	2	42.5	626	234	37.5

Garton (Kelso).

Treatment.	Percentage Germination. In Laboratory.	In Field. First Count. %	In Field. First Count. PE ±.	In Field. Mature Plants.	Plants. Total.	Plants. Smutted. *Ustilago levis.*	Plants. Smutted. *Ustilago Avenae.*	Plants. Percentage smutted.	Heads. Total.	Heads. Smutted.	Heads. Percentage smutted.
Control ..	98.0	75.0	2.04	61.0	122	36	12	39.4	285	105	36.9
pper carbonate No. 1	96.5	70.7	1.49	64.7	259	6	8	5.4	547	27	5.0
Control ..	98.0	63.5	1.82	50.5	101	34	15	48.5	211	97	46.0
pper carbonate No. 2	96.5	61.3	2.14	54.0	216	8	3	5.1	384	19	5.0
Control ..	98.0	66.0	1.65	55.5	111	40	6	41.5	215	86	40.0
lloidal copper ..	97.5	61.5	2.43	57.2	229	16	8	10.5	446	40	9.0
Control ..	98.0	63.5	1.80	48.0	96	49	4	55.2	187	117	62.5
mesan dust ..	96.5	68.0	1.79	55.5	222	63	27	40.6	438	164	37.5
Control ..	98.0	65.5	1.41	52.5	105	41	12	50.6	197	91	46.0
mesan steep ..	99.0	71.3	1.47	54.2	217	58	10	31.4	439	117	21.6
Control ..	98.0	63.0	1.56	51.5	103	31	6	36.0	202	63	31.2
rona 640 steep ..	98.5	69.7	1.63	48.7	195	84	22	54.2	372	182	49.0
Control ..	98.0	64.5	1.65	51.5	103	35	8	41.8	198	79	40.3
pulun	96.0	71.3	1.85	62.7	251	59	21	31.9	523	155	29.5
Control ..	98.0	72.0	1.20	53.5	107	35	7	39.3	228	77	33.7
rmisan	96.5	75.0	1.51	69.7	279	16	4	7.2	547	35	6.4
Control ..	98.0	67.5	1.81	56.5	113	49	5	47.8	205	89	43.4
ırke's Wheat Protector	97.0	65.5	1.52	52.5	210	32	10	20.0	373	78	20.5
Control ..	98.0	59.0	1.91	45.0	90	25	7	35.6	167	51	30.0
uestone 1% ..	99.0	59.7	1.98	50.0	200	13	4	8.5	374	26	7.9
Control ..	98.0	60.5	1.98	45.0	90	21	16	41.2	158	66	39.9
uestone 2% ..	83.5	54.7	1.70	51.5	206	8	0	3.9	361	13	3.6
Control ..	98.0	58.0	1.76	48.5	97	34	15	50.5	207	94	45.5
rmalin 1–320 ..	97.5	56.5	2.18	48.2	193	7	1	4.1	379	16	4.2
Control ..	98.0	63.5	1.70	45.0	90	29	14	47.7	169	78	46.1
rmalin 1–480 ..	94.5	61.5	1.53	52.2	209	22	2	11.5	414	39	9.4
Control ..	98.0	61.5	1.92	50.5	101	37	9	45.6	214	94	44.0
rmalin 1–320 presoak	69.0	70.3	1.52	63.5	254	21	0	8.3	597	37	6.2
Control ..	98.0	68.0	..	60.0	120	44	17	50.8	282	137	48.5

NOTE.—The PE of each control is computed in combination with the next succeeding control. (This does not apply to the hot-water series on next page.)

Table 3.—Experiments on Oat-smuts—continued.

Treatment.	Dun. Percentage Germination. In Laboratory.	Dun. Percentage Germination. In Field. First Count. %	Dun. Percentage Germination. In Field. First Count. PE ±	Dun. Percentage Germination. In Field. Mature Plants.	Dun. Plants. Total.	Dun. Plants. Smutted. *Ustilago levis.*	Dun. Plants. Smutted. *Ustilago Avenae.*	Dun. Plants. Percentage smutted.	Dun. Heads. Total.	Dun. Heads. Smutted.	Dun. Heads. Percentage smutted.	Garton (Invercargill). Percentage Germination. In Laboratory.	Garton. Percentage Germination. In Field. First Count. %	Garton. Percentage Germination. In Field. First Count. PE ±	Garton. Percentage Germination. In Field. Mature Plants.	Garton. Plants. Total.	Garton. Plants. Smutted. *Ustilago levis.*	Garton. Plants. Smutted. *Ustilago Avenae.*	Garton. Plants. Percentage smutted.	Garton. Heads. Total.	Garton. Heads. Smutted.	Garton. Heads. Percentage smutted.
Hot water—																						
4 hrs. @ 104°	..	..	..	..	..	..	..	..	..	..	..	97·5	74·0	2·18	66·2	265	104	0	39·2	680	218	32·2
6 hrs. @ 104°	..	..	..	..	..	..	..	..	..	..	..	97·0	70·5	2·24	64·2	257	90	1	35·5	720	228	31·8
8 hrs. @ 104°	..	..	..	..	..	..	..	..	..	..	..	98·0	79·0	1·32	74·2	297	106	0	35·7	808	255	30·4
10 hrs. @ 104°	..	..	..	..	..	..	..	..	..	..	..	98·0	74·0	1·90	71·7	287	66	0	23·0	798	148	18·5
12 hrs. @ 104°	..	..	..	..	..	..	..	..	..	..	..	94·0	72·0	1·58	70·2	281	34	0	12·1	813	73	9·0
Control	85·5	70·3	1·88	71·5	286	60	12	24·8	1,384	325	23·6	97·2	71·3	1·95	70·7	283	98	5	36·4	814	241	29·6
10 min. @ 121°	98·5	77·7	1·37	76·7	307	3	0	1·0	1,469	7	0·5	99·0	67·0	2·18	67·2	269	6	0	2·2	807	15	1·9
10 min. @ 125°	97·5	78·0	1·53	75·7	303	7	0	2·3	1,382	20	1·4	97·0	67·5	2·04	68·5	274	1	0	0·4	846	3	0·3
10 min. @ 127°	97·5	75·3	1·72	72·2	289	0	1	0·3	1,187	2	0·2	97·0	77·3	1·72	75·2	301	0	0	0	865	0	0
10 min. @ 129°	93·0	72·3	1·34	68·7	275	0	0	0	1,211	0	0	96·5	70·7	2·30	69·5	278	0	0	0	856	0	0
10 min. @ 131°	96·0	71·0	1·56	71·7	287	1	0	0·3	1,290	2	0·1	98·0	68·7	1·89	69·5	278	0	0	0	886	0	0
10 min. @ 133°	96·5	77·0	1·24	75·0	300	0	0	0	1,373	0	0	98·5	62·7	2·92	62·5	250	0	0	0	842	0	0
10 min. @ 137°	94·0	79·0	1·36	78·2	313	3	0	1·0	1,429	8	0·5	96·5	63·7	3·04	*59·3	178	3	0	1·7	555	6	1·1
Control	..	..	..	..	..	..	..	..	..	..	..	97·2	67·7	2·74	*64·0	192	68	2	36·4	600	179	29·8
6 hrs. @ 60° + 10 min. @ 121°	95·0	81·5	1·95	81·2	325	8	0	2·5	1,430	32	2·2	98·0	68·7	1·80	68·0	272	6	0	2·2	835	14	1·7
" @ 125°	95·0	74·7	2·10	74·2	297	5	0	1·7	1,361	8	0·6	99·0	72·3	2·06	69·0	276	8	0	2·9	851	16	1·9
" @ 127°	100·0	70·7	1·99	70·0	280	9	0	3·2	1,193	22	1·8	97·5	72·7	1·51	72·0	288	7	0	2·4	822	11	1·3
" @ 129°	96·5	74·7	1·58	72·2	289	6	0	2·1	1,309	12	0·9	98·0	72·5	2·20	69·2	277	20	0	7·2	803	45	5·6
" @ 131°	93·0	79·0	2·02	79·5	318	4	0	1·3	1,408	14	1·0	98·5	65·3	2·04	63·5	254	11	0	4·3	783	25	3·2
" @ 133°	80·5	61·5	1·98	62·5	250	11	0	4·4	1,121	27	2·4	93·0	66·0	1·82	64·0	256	19	0	7·4	709	50	7·1
" @ 137°	70·5	41·3	1·85	45·5	182	2	0	1·1	557	7	1·3	87·0	38·5	2·11	37·2	149	13	0	8·7	385	29	7·5
Control	85·5	69·5	2·02	66·0	264	54	11	24·6	761	169	22·3	97·2	65·5	1·86	62·7	251	97	2	39·4	783	259	33·0
6 hrs. @ 60° + 5 min. @ 121°	97·0	87·0	1·94	84·7	339	6	0	1·8	994	11	1·1	99·0	79·5	1·37	69·2	277	8	0	2·9	930	25	2·7
" @ 125°	98·0	83·3	1·22	79·7	319	6	0	1·9	957	11	1·2	99·0	75·0	1·50	75·0	300	8	0	2·7	949	16	1·7
" @ 127°	97·5	83·7	1·51	85·5	342	9	0	2·6	939	18	1·9	99·0	76·0	1·44	72·7	291	8	0	2·8	985	19	1·9
" @ 129°	96·5	85·3	1·58	86·7	347	6	0	1·7	913	13	1·4	98·0	78·3	1·49	74·5	298	14	0	4·7	994	35	3·5
" @ 131°	97·5	77·7	1·51	77·2	309	11	0	3·6	776	26	3·3	95·0	77·3	1·74	74·5	298	16	0	5·3	957	43	4·5
" @ 133°	97·5	82·3	1·62	76·2	305	3	0	1·0	783	3	0·4	98·0	71·5	1·82	68·2	273	8	0	2·9	860	19	2·2
" @ 137°	86·5	78·0	1·32	72·0	288	4	0	1·4	712	7	1·0	92·5	74·0	1·62	69·7	279	16	0	5·7	807	40	5·0
Control	85·5	73·5	1·46	68·5	274	63	10	26·6	626	164	26·2	97·2	70·3	1·18	62·0	248	117	3	48·2	715	285	39·8

* Three rows only.

1–320 method, while it increased the number of plants and heads produced, gave slightly less effective disinfection than the 1–320 solution without the presoak.

(5.) Hot-water treatments: Soaking in water held at 104° F. for from four to twelve hours failed to disinfect the seed, though the percentage of smut which developed was reduced, especially at the ten- and twelve-hour periods. No apparent injury was done to the seed. Dipping the seed for ten minutes at temperatures ranging from 121° F. to 137° F. gave interesting but rather contradictory results. With the Garton variety, giving in the adjacent untreated control 29·6 per cent. of smutted heads, the sample dipped at 121° gave 1·9 per cent. smut; at 125°, 0·3 per cent. smut; at 127°, 129°, 131°, 133°, no smut; while at 137° again appeared 1·1 per cent. smutted heads. With the Dun variety the results are still more irregular, for only at 129° and 133° is the smut eliminated, though the highest amount showing at the other temperatures is only 1·4 per cent. smutted heads, against 23·6 per cent. in the adjacent untreated controls. No apparent injury was done to the seed. Presoaking the seed for six hours at 60° F., followed by dipping for five and ten minutes at temperatures ranging from 121° F. to 137° F., in no case gave complete control of the smut.

Both species of oat-smut, *Ustilago levis* and *U. Avenae*, were present on all the samples used in the experiments, the former species greatly predominating, but no difference could be detected in their reaction to the various methods of treatment.

EXPERIMENTAL METHOD.

Material. — Three lines of naturally smutted oats were used, two being of the Garton variety from different localities and the other of the Dun variety. All were harvested in 1925. Both *Ustilago levis* Magn. and *Ustilago Avenae* Jens. were present on all three samples.

Treatment. — Samples of about 1,000 seeds from each line were treated as follows:—

Copper carbonate: No. 1, Corona Coppercarb—dusted at rate of 6 oz. per bushel. No. 2, Stauffer's—dusted at rate of 3 oz. per bushel.

Colloidal copper (manufactured by the Pittsburg Plate Glass Company, U.S.A.): Dusted at rate of 4 oz. per bushel.

Semesan: Dusted at rate of 2 oz. per bushel. Steeped for two hours in 0·25 per cent. solution and dried.

Corona 640: Steeped for two hours in 0·25 per cent. solution and dried.

Uspulun: Steeped for two hours in 0·25 per cent. solution and dried.

Germisan: Steeped for half-hour in 0·25 per cent. solution and dried.

Clarke's Wheat Protector: Kept moist for thirty minutes with 7·3 per cent. solution.

Bluestone: Steeped for ten minutes in 1 per cent. and 2 per cent. solution copper sulphate, then kept moist for thirty minutes.

Formalin: Steeped for ten minutes in 0·3 per cent. and 0·2 per cent. solution of 39 per cent. formaldehyde, then kept moist for thirty minutes. "Presoaked" method consisted in soaking the seed for six hours in water, followed by ten minutes steep in 0·3 per cent. formalin, then kept moist for thirty minutes.

Controls: From the same bulk samples untreated.

The Clarke's Protector, bluestone, and formalin samples were treated on the same day as sown; the other treatments from ten days to a week before sowing.

Sowing.—The seed was sown 2 in. apart, 100 seeds to a row, rows 1 ft. apart. Four rows were sown of each treatment, and two rows of untreated control, except in the hot-water series, where four rows were used for control. Each row was divided during counting into four sections, on which the percentage germination was estimated separately, the probable error of the mean percentage being computed by Bissel's formula $P_E = \pm 0{\cdot}6745 \sqrt{\frac{\Sigma d^2}{n(n-1)}}$. Sowing dates, 16th to 26th October, 1925. First count, 24th to 26th November, 1925. Plants finally pulled, 19th to 24th January, 1926.

For fuller particulars of materials and methods see this *Journal*, Vol. 30, pp. 302–13.

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Forest Entomology.—In the course of his foreword to the State Forest Service bulletin "Forest and Timber Insects in New Zealand," Mr. David Miller remarks: "In the past, forest entomology has been neglected in New Zealand, and although at present there are insufficient data available, except in some isolated cases, from which a computation can be made of the actual loss due to insects, there can be no doubt that a very appreciable amount of depreciation takes place, the full extent of which will be recognized, and a great deal of it prevented, only when a better knowledge of the forest and timber insects in the Dominion is at hand. A review of the forest history of such countries as Europe and North America will reveal that the annual loss directly due to insect depredation is enormous; and we have ample evidence that the same condition prevails, and has prevailed, in this country both in our native forests and exotic plantations."

Electro-culture Investigation.—The work carried out at Rothamsted, England, since 1918 has shown that under field experimental conditions an increased yield of 20 per cent. on the average may be expected when certain spring-sown cereals are subjected to high-tension electrical discharge, also that under both field and pot experiments electrification has accelerated reproductive growth (grain) much more markedly than vegetative growth (straw).

THE PROGRESS OF ECONOMIC ENTOMOLOGY IN AUSTRALIA AND NEW ZEALAND.

Presidential address to the Biology Section of the New Zealand Institute Science Congress, Dunedin, January, 1926, by Dr. R. J. TILLYARD, Cawthron Institute of Scientific Research, Nelson.

IN this address I have purposely excluded references to the progress of economic entomology, except *en passant*, in other parts of the world, but have just as deliberately included Australia—firstly, because the attempt to deal with that progress in the whole world would occupy far more time than can be devoted to this address, and, secondly, because the problems of Australia and New Zealand are inextricably interwoven, and if we turn our eyes away from Australia we shall fail to learn half our lesson. An apple-orchard in Australia and an apple-orchard in New Zealand possess far more points in common than they possess differences. Ecologically, one is no more a part of Australia than the other is a part of New Zealand, but both are little pieces of Old England transplanted to a new environment, with the same old pests—codlin-moth, woolly aphis, and the rest of them—and the same problems of cultivation, spraying, picking, and marketing. The new environment, however, modifies the conditions to a considerable extent in so far as there are soil and climatic differences to be considered and a certain number of pests native to the country added to those brought in from outside. The same is true of a pine forest or of a dairy farm ; it is not, ecologically, a bit of New Zealand or Australia, but an exotic development upon a native soil very differently occupied until the white man came on the scene. It is a piece of *disturbed country*, like that of a nation through which the scourge of war has passed. Never again can it settle down to its original condition, and never can it continue in the artificial condition apportioned to it by man unless he himself is prepared to give it constant supervision and attention. In respect of any such piece of ground innumerable problems—agricultural, chemical, horticultural, entomological, and mycological—press upon him for solution, and the final success of his experiment depends on how he is able to deal with them.

Now, in this address I propose to examine the progress which has been made in recent years purely as regards entomological problems only, and to try to indicate the lines on which future progress must be made. In doing this I shall divide the subject into two main sections —namely, (1) the control of injurious insects, and (2) the utilization of insects to control noxious weeds.

I. THE CONTROL OF INJURIOUS INSECTS.

The outstanding feature of the past few years, to my mind, has been the marked increase in the application and success of the biological method of control of injurious insects by means of their natural enemies, both parasites and predators. Only six years ago, at the First Imperial Entomological Conference in London, there were more speakers opposed to this method than in favour of it, and the great majority were in

a position of doubt, not knowing what to think about it. This was inevitable, of course, in so conservative a centre as London and in view of the backward state of entomology in the Empire as compared with America. The best speech in favour of the biological method was made by a visitor, Dr. L. O. Howard; and I am not ashamed to own, for my part, that he carried me with him entirely, and that I am now an enthusiastic supporter and worker for this method. New Zealand already owes more to Dr. Howard than to any other living entomologist, for it was through him that we have been enabled to introduce a number of most valuable enemies of some of our worst insect pests and to make marked progress in the work of establishing them permanently within the Dominion.

One of the curses of entomology, as, indeed, of all branches of science to a greater or less degree, is facile generalization from insufficient facts. My experience with biological control leads me to state here that no generalizations are worth anything in this particular case, for the simple reason that the amount we know about the habits and psychology of insects is so small compared with the vast amount still unknown that there is only one safe method of procedure—namely, to test every case on its own merits and as thoroughly as possible.

To illustrate this I will outline the recent history of the control of woolly aphis in New Zealand and Australia. There are in America, the original home of the pest, three types of insects concerned in its natural control—namely, (1) certain syrphid flies, (2) the ladybird *Hippodamia convergens*, and (3) the chalcid wasp *Aphelinus mali*. As closely similar syrphid flies already exist in New Zealand I did not make any attempt to introduce the American species. In considering the other two all the evidence was in favour of *Hippodamia*. This ladybird has a wonderful record in California, and is rightly looked upon as one of the most valuable of known beneficial insects. Large sums of money are spent in rearing, collecting, and distributing it, and every fruitgrower is fully convinced of the benefits it confers upon him. *Aphelinus mali*, on the other hand, is not thought much of. Moreover, it had already been introduced into South Africa, where it was a failure. Anybody with a ready faculty for generalization might have been tempted to concentrate on *Hippodamia* and write *Aphelinus* down as foredoomed to failure. I confess that I was on the verge of making this decision, when a conversation with a Canadian scientist on the apparently unrelated subject of biological strains or races gave me a new idea about it. We were studying two races, exactly similar morphologically, of a small dipteron, one of which lived only on one host plant and was of economic importance, and the other lived on an entirely different host plant and was of no economic importance whatever. In spite of apparent absence of morphological differences, experiments proved that you could not make the progeny of the one race live on the host plant of the other, and *vice versa*. My Canadian friend wanted to argue that they were therefore distinct species; but I would not agree, and countered his argument by asking him what he would do in the case of two morphologically similar races of a single species, one living, say, in a cold climate, on a given host plant, and having a single brood annually, and the other living in a much warmer climate, on the same host plant, but having two or three broods a year. The argument was left unfinished, but it suggested to my mind that the

value of a beneficial insect might be greatly increased in a new country if, instead of introducing consignments from one locality only, two or three localities with widely different climates were to be selected, and the biological races received from these were to be crossed before liberation in the new country. With this end in view I arranged with Dr. Howard to send supplies of *Aphelinus mali* from three States—Connecticut, Georgia, and Arkansas—having very different climates. We have no evidence that any progeny containing the Georgia strain survived the first winter, but individuals from the other two strains were observed to pair, and their progeny was recovered in the following spring from the tree on which they were placed. It will always be a matter of some doubt how far this crossing has been responsible for the success of *Aphelinus mali* in New Zealand, but that it has been *one* of the factors making for success I feel certain.

At the present time woolly aphis is well under control in New Zealand owing to the work of this parasite, which has proved of the greatest help to orchardists throughout the Dominion. *Hippodamia convergens*, on the other hand, though liberated in thousands throughout the Nelson Province, has not since been seen or heard of, and it is probable that this insect's known habit of seeking the tops of high mountains on which to hibernate has proved its undoing in New Zealand and in every other country in which it has been tried.

The New Zealand strain of *Aphelinus mali* has been sent across to Australia, and has already done splendid work in the apple districts of the States of Queensland and Western Australia, while the latest reports show that it is beginning to make its mark in the other States, where its propagation was greatly hampered by severe quarantine restrictions. The same strain has also been sent to South Africa, where it will be interesting to note whether it does any better than the original pure strain introduced there some years ago.

I think it may be claimed that *Aphelinus mali* is the first case of outstanding success with an *internal parasite* of an injurious insect present in New Zealand. In the case of predators—*i.e.*, beneficial insects which prey upon their host from outside—two marked successes at least had been obtained previously in New Zealand by the Department of Agriculture—namely, *Novius cardinalis* in controlling cottony cushion scale, and *Rhizobius ventralis* in controlling blue-gum scale. Of these, the experiment with *Novius* is now of long enough standing for us to be able to answer the oft-repeated question, "What happens to the beneficial insect when its host is exterminated?" In the Nelson District cottony cushion scale was practically exterminated for a number of years, and *Novius* disappeared with it. But the cottony cushion scale had one refuge where *Novius* either failed to follow it or only followed it tardily—namely, on gorse—and from this refuge, when the local population of *Novius* was almost extinct, the scale has again made its appearance and spread abroad on to wattles, kowhai, boronia, and other plants. At the present time this pest is doing quite a fair amount of damage in Nelson, and a room has been set apart in the Cawthron insectaria to rear it and to study its enemies further. Not only *Novius cardinalis*, but a small fly, *Cryptochaetum iceryae*, attacks the cottony cushion scale, and both of these can be made use of for the control of this pest when required.

The question may be asked here, Is the internal parasite preferable to the external predator in the control of a pest? The answer I would give is that again we must not generalize, but must take each case on its merits. Other conditions being equal, we should not be biased in favour of one or the other, but should be prepared to utilize that one which shows best, by experiment, its ability to exercise control of its host. In the case of orchards, however, or other areas which are regularly sprayed, it is obvious that the internal parasite will have an advantage over the external predator, since the latter may well be killed by the spray, while the former will, at any rate, escape during part of its life when it is sealed safely up within the body of its host.

The success with *Aphelinus mali* was the direct result of the sending by the New Zealand Government of a representative to the First Imperial Entomological Conference in London. Five years later, in June last, a second similar Conference was held, and New Zealand again sent a representative in the person of Mr. J. G. Myers. This brilliant young entomologist has already justified his mission by the discovery of internal parasites of the pear-leaf-curling midge, *Pirrisia pyri*, and the first supplies of these insects are already in the hands of Mr. David Miller, the Government Entomologist. This is another case of a most serious pest to orchardists, and one which defies all attempts to control it with sprays. I am sure you will all agree with me when I say that we hope Mr. Miller will have with these little insects a success as great as that which attended the introduction of *Aphelinus mali*.

I now wish to bring before your notice two related problems in the biological control of insect pests. One of these is illustrated by the work done with the Australian ladybird, *Cryptolaemus montrouzieri*, in the control of mealy bug in orchards, and the other by the attempt to introduce into New Zealand the chalcid wasp, *Habrolepsis dalmanni*, for the control of oak-scale, *Asterolecanium variolosum*. In the first case it is found that, even in the comparatively warm climate of California, the ladybird starts too late in the season to make any impression on its host. But if the ladybird is reared artifically in warm insectaria it can be sent out in great numbers earlier in the season to all points where mealy bug threatens to become a serious pest, and in this manner the pest is regularly checked. What is true of California has been proved true of New Zealand, both by Mr. Miller and myself. But neither he nor I have a staff of assistants large enough to enable us to carry on work of this sort and at the same time to attend to the numerous other pressing problems which are calling for solution. We may state definitely at the present time that if mealy bug becomes in any given season a serious pest in New Zealand the early and abundant distribution of *Cryptolaemus* ought to be undertaken in order to check it as soon as possible. Fortunately, our New Zealand climate is not so favourable to this pest as is that of California, and an exceptionally severe winter, like that just past, gives it a severe set-back. At present there is very little mealy bug in Nelson orchards, but it is highly probable that the pest will reassert itself after two or three more favourable seasons.

The other problem is one of considerable scientific interest—namely, the difficulty of dealing with insects which reproduce parthenogenetic-

ally when introducing them into a new country. In the case of *Habrolepsis dalmanni* nothing was known of its life-history when the attempt to introduce it into New Zealand was first made; but we now have enough evidence to make it highly probable that in the case of this chalcid, as in some other Hymenoptera, the unfertilized females produce males only, while the fertilized females produce either wholly or mostly females. Now, you will appreciate the delicacy of the situation when you learn that, after repeated trials with consignments of oak-scale from which few or no parasites have been obtained, the last lot received by the Cawthron Institute has yielded a single male and no less than 427 females emerging over a period of more than a month! If the progeny of these become acclimatized in our insectaria and emerge in the spring of the present year it will all depend on that solitary male whether we shall get a mixed brood or an immense number of males only. If the latter event happens, then that is again the end of the attempt. The only solution seems to be to time a further consignment from America in such a way that the females derived from it may pair with the males derived from the present lot of 427 females. And even then our difficulties are not at an end, for if we overdo the business, so that *all* these new females become paired, we may obtain only females at the next brood, and only males from the second brood following! You will see from this how great a difficulty parthenogenesis introduces into these economic problems, and how delicate must be the balance in nature which, in its natural habitat, enables an insect like *Habrolepsis dalmanni* to continue year after year without running out entirely to one sex or the other. The very fact that from one consignment of oak-scale only a single male was obtained to 427 females shows how nearly, even in a state of nature, such an insect can come to extermination in one locality or another, and suggests to us that it may possibly be only by the interaction of a number of thriving colonies that we shall at last attain success.

While on this subject of parthenogenesis I may as well mention a second instance due to it of failure to establish a beneficial insect in New Zealand. Three years ago the Cawthron Institute received from Dr. Imms, Chief Entomologist of the Rothamsted Experimental Station, England, a consignment of cocoons of the well-known pear-slug *Caliroa limacina* parasitized by the ichneumon fly *Perilissus luteolator*. In the spring of 1923 not a single insect emerged from these cocoons, but a year later, during a much wetter spring, a number of pear-slug adults emerged, followed by about forty of the parasites, both sexes being represented. Most of these were liberated in the insectarium, with a plentiful supply of well-grown pear-slugs on small plum-trees, while a few were set free on two cherry-trees in the open. In both cases the ichneumons were seen feeding on the slimy exudation of the pear-slug, and the females were observed attacking them and laying their eggs in them. But it is sad to relate that every single ichneumon which has appeared in our cages this season has been a male. Either *no pairing* took place between the males and females of last year's brood, and the unfertilized females attacked the pear-slug, laid their eggs in them, and have produced only male progeny, or else *all* the females paired and produced male offspring only!

One lesson to be learnt from the above-mentioned failure is the great difficulty of obtaining success with small consignments. One might think at first that the liberation of, say, ten males and ten females would be practically certain to ensure pairing. This is not so. In many cases females and males of the same species do not even frequent the same places or have similar habits, and their meeting and pairing may only take place when certain fixed conditions of feeding and maturation have been fulfilled. What these conditions are in the case of *Perilissus* is not known. We hope to continue the attempt to introduce it, but it is clear that very much larger initial supplies will be needed for success.

It is inevitable in the case of experiments such as these that a large percentage of failures should be recorded. Some of these are absolute failures, without a single redeeming feature, as in the case of *Hippodamia convergens*. Others, like those cases of parthenogenesis mentioned above, are failures from which we may learn valuable lessons with which to pave the way to future success. There are many causes of failure which are not within the control of the workers themselves. One of these, a very sad one, I have to record in the case of the attempt to introduce parasites of the earwig into New Zealand.

The European earwig, *Forficula auricularia*, is, as most of you know, a serious pest in New Zealand, particularly in Otago. In the Central Otago orchards it is the worst pest of stone-fruit present. The Imperial Bureau of Entomology in London took up this question, and arranged with Dr. Imms at Rothamsted for a student to be given complete charge of this work. Mr. H. M. Altson was selected, and as a result of his work initial supplies of two parasites were sent out to the Cawthron Institute. These consisted of 120 puparia of *Digonochaeta setipennis*, and, later on, 1,400 live earwigs stated to be parasitized with *Racodineura antiqua*. Owing to the great difficulty of the work, a continuance of supplies over at least two whole years was essential. But, unfortunately, Mr. Altson fell ill, and there was nobody who could carry on the research. We now learn with the greatest sorrow that his illness is quite incurable, and that he will never again be able to take up this important work.

As this question of control of the earwig is of special interest to Otago I hope I may be pardoned for discussing it somewhat more fully. The insects mentioned above, the only two parasites known which are likely to offer a chance of successful control, are both flies of the family Tachinidae, and neither of them is easy to handle under insectarium conditions. *Digonochaeta setipennis* is larviparous, depositing young living larvæ in the haunts of earwigs; these larvæ move rapidly about, seeking for their prey, the latter showing evident signs of fear in their presence and hiding in dark corners. When the young *Digonochaeta* larva reaches an earwig it bores into it and feeds on its internal tissues, finally issuing fully fed from the destroyed host and forming the usual barrel-like puparium near its remains. In the case of *Racodineura antiqua* the procedure is very different. The females seek out leaves and vegetable remains which have been nibbled by earwigs, and deposit on them minute, black, seed-like eggs. These are swallowed by the earwigs, and the young larvæ hatch out

inside them and devour the internal organs of the host, finally pupating much as in the case of *Digonochaeta*. Under insectarium conditions we succeeded in taking both these flies through two complete broods, but we were not able to keep the percentage of parasitism high enough to ensure success of the experiment. The second brood in each case consisted of so few individuals, emerging at wide intervals apart, that the work could no longer go on without fresh supplies. Further, in the case of *Racodineura* it was noted that only eighty out of the original 1,400 earwigs sent from England yielded puparia—*i.e.*, the amount of parasitism was under 6 per cent. This percentage dropped still lower when we worked with Nelson earwigs.

One unexpected difficulty was met with in the case of *Racodineura*, but was overcome by the ingenuity of Mr. Tonnoir, who was at that time working in the Cawthron Institute as research student in Diptera. The earwigs were given slices of potato or apple to nibble, and when these were put into the cages where the fertilized females of *Racodineura* were confined the latter laid a great number of eggs on them. The slices were then returned to the earwig-cages, when it was found that the earwigs ate them readily enough, but left each little egg standing up on a high pinnacle untouched! This most unexpected set-back was countered by Mr. Tonnoir, who, knowing the fondness of earwigs for dandelion-leaves, tempted them with these. They fed readily enough, and the flies laid their eggs on the nibbled pieces; these, when returned to the earwig-cages, were finally devoured, and thus parasitism was at last secured.

The experiments with these two flies appear to indicate that, given adequate supplies to start with, and working as close as possible to nature—*i.e.*, not with closed cages in insectaria, but with baited traps in the open, into which the earwigs could be attracted by hundreds —*Racodineura* and possibly also *Digonochaeta* could be permanently established in New Zealand. But whether either of these flies, or even both together, will give a sufficiently high percentage of parasitism to control the pest to any great extent our experiments do not enable us to say. The attempt must certainly be made, and it will be one of the principal objects of my forthcoming visit to America and Europe to try to arrange for abundant supplies of both parasites in the near future.

New Zealand is the only large area of land in the world, exclusive of the frigid zones, in which the green lacewings, family Chrysopidae, are not represented by native species. These insects feed on various species of aphids; their larvæ have peculiarly formed sucking mouth-parts and are very voracious. In most parts of the world they are only sporadically beneficial, owing to the large number of parasites from which they suffer. If these insects could be acclimatized in New Zealand without their own parasites it seems highly probable that they would prove of very great benefit in the control of a number of introduced aphids, such as those of pine, spruce, and oak. Attempts have been made from time to time to introduce various species of Chrysopidae into New Zealand from America and Australia, but all have failed from one cause or another. More recently a large shipment of 1,900 hibernating green lacewings has been received by the

Cawthron Institute from Canada, through the co-operation of the Dominion Entomologists in Ottawa and the State Entomologists of British Columbia. These insects arrived in excellent condition, only about fifty being dead. A large number were sent down immediately to Christchurch in order to make an attempt at controlling the oak-aphis. Both in Nelson and Christchurch a considerable number of eggs were laid, and the larvæ hatched from them are at present feeding vigorously on various species of aphids. Further consignments are being arranged for in the near future.

The problem of saving the oaks in Canterbury is a difficult one, as it appears to be the damage done by the combined attacks of oak-aphis and oak-scale which is the cause of their serious condition. The solution to be aimed at must be efficient control of both these pests. This should be attained to a large extent by the successful acclimatization of both *Habrolepis dalmanni* and a suitable species of *Chrysopa;* but there is still a considerable way to go before this desirable end is achieved.

The codlin-moth, *Laspereysia pomonella*, is, as you all know, one of the worst pests which orchardists have to contend with in all parts of the world. Only the most careful and rigid attention to the spraying schedule will ensure to an orchardist freedom of his crop from the injury done by it. In New Zealand there are known to be two distinct broods of this moth, and the main effort of the orchardist is in the direction of getting his arsenical sprays on to the trees at the right times to check the newly-hatched larvæ of these two broods before they can enter the apples. Recent observations, however, indicate that there is a more continuous succession of moths throughout the summer than is generally supposed. The two broods are, in fact, only the crests or maxima of the wave-like curve on the graph indicating the number of emergencies week by week from October to May. Two entomologists in the University of Colorado discovered a few years ago that codlin-moth could be easily trapped by means of fermented apple-juice placed in jars hung in the upper third of the trees. This experiment has been repeated recently in a Nelson orchard, and also by a South Australian grower. Both got closely similar results, which are rather remarkable when we consider that the experiments were carried out on clean orchards where codlin-moth has been controlled by careful spraying for many years.

In the Nelson orchard fifty-five small tins were used, hung between the upper limbs of consecutive trees in one section of the orchard. During November and December, when the experiment was being carried on, high winds prevailed nearly all the time, a most unusual state of affairs for Nelson. A number of tins were blown about violently and their contents spilled, so that the total recorded falls short of the actual catch. The supply of apple-juice gave out on the 23rd December. For the period of seven weeks the following catch was secured: Number of codlin-moth, 305, of which 218, or 72 per cent., were females; number of leaf-roller moths, 198; number of other insects, 5,468, of which 7 per cent. could be classed as beneficial, the rest being either injurious species such as cut-worms, &c., or of no account.

In the South Australian experiment sixteen large tins were used, and four of these were placed near a neighbouring orchard whose owner had neglected to spray carefully. In three weeks during the latter part of November and first part of December 442 codlin-moth were caught, 66 per cent. being females. More than half of these were trapped in the four tins near the neglected orchard!

I mention these results particularly on account of the recent outcry in Great Britain against the sale of apples having arsenical sprays on them. At the present moment there does not appear to be any reason to think that New Zealand apples which have undergone the full spraying programme will come under the ban. The scare, however, has started, and I think we ought to be considering whether we might not reap a great advantage by substituting either a spray harmless to man, or else a trapping method for the later sprays in January and February, which are the ones which leave arsenic on the exported apples. The country which could place the label "No arsenical spray on these apples" on all exported cases of that fruit would undoubtedly reap the benefit over other countries in higher prices and a more ready market. So I shall express the hope that next year some groups of orchardists will take up this question of trapping more extensively and carry on larger experiments right through from one end of the season to the other.

You will see from the above account that much has been done in the past few years towards an increase in our knowledge of economic entomology in New Zealand, particularly as regards the biological method of control of insect pests. There is, however, a hundred times as much left undone, for lack of the trained men and resources needed to carry out the work. Even the preliminary work, such as the working-out of life-histories, is still undone in the case of some of our worst pests. The valuable work done by Mr. David Miller in his study of the life-history of the pear-leaf-curling midge and the New Zealand grass-grub must form the essential basis on which any scheme of attack on either of these two pests must be built up. The life-history of the New Zealand bronze-beetle is still to a great extent unknown. Many examples could be given of pressing pioneer work which badly needs to be done.

(To be continued.)

Farmers' Field-days.—Writing on a field-day held at the Merredin State Farm, the editor of the *Journal of the Department of Agriculture of Western Australia* thus defines a farmers' field-day: "It is an annual exposition of results from patient effort harnessed to trial, experience, experiment, and condition; an education in a nutshell; bovrilized farm science. It is a gift from the Government of the day to its husbandmen of knowledge painstakingly acquired, and a plan scientifically designed for the opening-up and development of fields and pastures to the limit of the State's soil and climatic capacity. It is also a sign-post at the cross-roads of success and failure."

Forty per cent. of the bulk of a fertile soil should be air and not stagnant water. Oxygen in the soil is necessary for the establishment and maintenance of the highest-class plants that a soil will carry. Drainage provides oxygen to water-ridden soils.

MANUFACTURE OF WHEY BUTTER.

FAULTS AND HOW TO REMEDY THEM.

J. W. SMITH, Dairy Instructor, Palmerston North.

THE making of whey butter as a by-product of cheese-manufacture is now generally adopted in New Zealand; for the year ended 31st March, 1925, a total of 1,290 tons was graded at the various ports. Special regulations under the Dairy Industry Act deal with the manufacture and branding of whey butter. All packages containing the product must be clearly branded as such. Any butter made from a mixture of whey cream and fat separated from milk must also be branded "whey butter."

Whey contains from about 0·15 to 0·3 per cent. of fat, but no definite percentage can be stated, as this varies according to the richness and the acidity of the milk, and more particularly with the carefulness of the cheesemaker in handling the curd. Since the introduction of centrifugal separators it has been possible to skim the whey very exhaustively, and there is no consistent reason why the fat derived from the whey should not produce a butter equal in quality, or nearly so, to that of ordinary first-grade creamery butter (scoring 90 points), provided that the whey is skimmed promptly after it leaves the cheese-vat, and that the whey cream is properly pasteurized and cooled before it is churned. Factory-managers and buttermakers are apt to treat this valuable by-product with a certain amount of indifference. On the other hand, it is a fact that during past seasons some factories which paid particular attention to the manufacture of their whey butter received within 1s. per hundredweight of creamery-butter prices.

It is regrettable to note, however, that on the whole during the past few years the quality of our whey butter has been going back. This can be attributed to the following reasons: (1) Saving the whey from the cheese-presses; (2) insufficient care and cleanliness of the plant; (3) inefficient and out-of-date plant; (4) lack of experienced operators.

Although frequently practised, the saving of the whey from the presses is not to be commended, and the method of collecting the fat which drains from the presses overnight and putting it into the bulk of the whey to be separated must be condemned. Insufficient care and cleanliness of the plant are the cause of the majority of faults in our whey butter to-day. Managers and dairy companies would be well advised to take a much keener interest in this branch of the work when their whey butter is placed second grade. As regards inefficient and out-of-date plants, it is surprising to find many of our leading factories poorly equipped for whey-butter making. Lack of experienced men to operate the plants is commonly met with. Except in cases where a permanent whey-butter maker is employed, one generally finds the latest addition to the staff in charge of the whey-separator and butter-making. This is decidedly unsound, for the inexperienced man in a great many cases costs double his pay in the wear-and-tear of separator parts (such as from over- or under-oiling), loss in fat-separation, loss in moisture, salt, and fat content of the butter, and very often a resultant low-scoring butter.

TREATMENT OF THE CREAM.

Assuming now that all the foregoing defects have been remedied, and it is desired to manufacture a first-grade whey butter, I would recommend in the first place that the separator-screw be set to secure a whey cream containing from 45 to 50 per cent. of fat, so as to permit the addition of a large amount of water or milk to the cream before pasteurizing. The manufacture of whey butter at a cheese-factory differs somewhat from that manufactured at a butter-factory. At a cheese-factory, where milk is plentiful (and the demand for the yield is not excessive), I would recommend the maker to break down with milk the percentage of fat in the whey cream to 36 to 40 per cent. and to pasteurize immediately after separating, adding to the cream before churning, if need be, any surplus starter that may be over from the cheesemaking department. Where the cream is held at the cheese-factory overnight before railing to the butter-factory it is advisable to pasteurize it up to about 175° F., taking care that this temperature is reached in not longer than twenty minutes, carefully agitating with a metal plunger during the heating process, and immediately cooling the cream down as low as possible. This checks the acidity and assists to eliminate some of the volatile flavours.

At a butter-factory, where milk is less plentiful, I would recommend the maker to break down the percentage of fat in the whey to 36 to 40 per cent. with pure clean water, check the acidity, and neutralize down with bicarbonate of soda to about 0·13 of acid "off the cooler"; then pasteurize the cream to about 192° to 204° F. No set rule as to pasteurizing-temperatures can be stated; this must be determined by the maker, as the condition of the cream and local conditions vary. Immediately after pasteurizing cool the cream down, and, if possible, add at least 5 per cent. of pasteurized milk to the cream in the vat. A good, clean, lactic starter can be added with advantage to the cream before churning; care, however, must be taken so that the maximum acidity at churning is not more than about 0·15 of 1 per cent.

CHURNING AND WORKING.

No set rule as to churning-temperatures can be stated, as they also vary according to local conditions. However, the buttermaker should remember that whey butter has a greater tendency than ordinary butter to soften when exposed to atmospheric temperatures; consequently the churning-temperatures should be sufficiently low to obtain a good, firm-bodied butter. If the churn is driven at the correct speed and is not overloaded, the churning should break in from twenty to thirty minutes. The churn should be stopped when the granules are still small; the grains should not be as large as when churning creamery butter. Particular care should be exercised in the washing of the granules. After practically all the buttermilk has run off, spray about two to three buckets of chilled water (according to the size of the churning) over the butter from the front of the churn by placing the hand over the hose-pipe; then allow this water to drain off. Now add the wash-water proper, sufficient to float all the granules; then put the churn on the high gear and spin for at least fourteen to twenty turns. After the wash-water has drained off open up the churn, and again spray over the granules sufficient chilled water to ensure that all

traces of sediment are washed out; then salt the granules, again close the churn door, and spin on the high gear for at least twenty turns. Now insert the butter-worker, and work the butter with both taps closed until the moisture content reaches, say, 15 per cent. The churn should then be stopped, allowing all surplus brine to drain off, and the butter then worked up to a finish, which may take from three to five minutes, according to the working of the churn. A final moisture-test should be taken, which should show a gain of ½ per cent. in water content.

There is in buttermaking an art and a knack which requires perhaps years of experience and judgment, and cannot easily be taught by rule of thumb or by written directions by those who have mastered the art for themselves. We find buttermakers drawing their supply of cream from the same district, working upon similar temperatures, &c., yet one maker's finished product is easily worth one point higher in grade. The reason for such a difference is obvious: one maker knows when he has made butter, the other man does not know.

The body and texture of much of our whey butter is open to improvement. Professor O. F. Hunziker, in commenting upon the body and texture of butter generally, states: "A well-made butter has an influence upon the flavour. This should not be interpreted to mean that the make and flavour are entirely dependent on one another; they are not; defects in the one are not infrequently accompanied, if not caused, by certain defects in the other. For instance, fermentations that cause the protein elements to surrender their jelly-like colloid character, which precipitates the casein into contracted, hard, dry particles, making proper moisture incorporation difficult and necessitating excessive working of the butter, which in turn tends to injure the smooth and waxy body which is most desired. There is always this tendency when butter is made from a very high acid cream. Faulty working does interfere with the flavour, and may impair the keeping-qualities of the butter. The working of the butter deals with the natural and mechanical causes and the effects, while the flavour and keeping-quality have to do with the bacteriological and chemical agencies and reaction. In order to obtain perfection of one you must necessarily have a certain amount of perfection in the other. The body and texture of butter are to a large extent controlled by a great variety of factors; some are beyond the control of the buttermaker, over others he has a partial control, and still others, while under control, require his constant attention and adjustment according to local conditions and seasonal changes." It is for this reason that no definite set rule as to pasteurizing and churning temperatures can be laid down to suit all factories.

MOISTURE, FAT, SALT, AND CURD CONTENT.

Speaking generally, whey-butter makers do not attach sufficient importance to this branch of the work. It would appear, in respect to the moisture or water content, that as long as it does not exceed the legal limit in butter forwarded to the grading-stores they are satisfied. Given modern appliances and sufficient labour to conduct the buttermaking, it is not unreasonable to expect buttermakers to turn out whey butter similar in composition to creamery butter. The best made creamery butter to-day contains on the average about 15 per cent.

of water, $1\frac{1}{2}$ to 2 per cent. of salt, 1 per cent. of curd, and 82 per cent. of fat. In practice it is by no means uncommon to find whey butter containing 12 per cent. of water and from 84 to 85 per cent. of fat.

The overrun from fat in whey in many instances must be much lower than it need be. If 1·75 per cent. of fat is allowed for manufacturing-losses, the overruns of butter containing from 82 to 85 per cent. of fat are as follows: Butter containing 82 per cent. fat, 19·81 per cent. overrun; 83 per cent., 18·37; 84 per cent., 16·96; 85 per cent., 15·58. The difference between a 19·81-per-cent. and a 15·58-per-cent. overrun is 4·23 per cent., and, valuing butter at 1s. per pound, is equal to 0·5d. per pound of butterfat in whey cream. It will be recognized that due attention to this branch of the work is profitable to manufacturers of whey butter.

FLAVOURS IN WHEY BUTTER.

Characteristic flavours in whey butter and their probable causes may be described as follows:—

Whey flavour: Butter made solely from fat skimmed from whey which has passed through clean drains, whey-tanks, and subsequent utensils is not at all objectionable in flavour.

Oily flavour: Very similar to cod-liver oil. Probably due to saving the press-fat, having too high a fat content in the cream, pasteurizing at too high a temperature, or holding at a high temperature for too long a period, and not churning often enough. This class of flavour is often noticeable in highly coloured butter (the result of making coloured cheese).

Mutton-fat flavour: Probably due to using a thick cream insufficiently broken down, high churning-temperatures, and washing with excessively low-chilled water.

Cheesy flavour: Suggestive of saving the press-fat, which has been tainted by the rough, whey-soaked cheese-caps and by passing down a dirty press-chute.

Dirty flavour: The most objectionable flavour is the real dirty flavour due to leaky whey-tanks or drains, or to insanitary conditions existing in some part of the plant.

GENERAL.

Poor-quality whey butters have a tendency to become tallowy, while the butter sometimes becomes white and lardy in appearance during storage. Our London Inspector, Mr. Walter Wright, reports that whey butter can always command a market if the quality stands up to first-grade marks, but that inferior quality is always difficult to dispose of. This goes to indicate that a successful buttermaker must be cleanly about his work, both inside and outside of the factory, keeping accurate records of his work and a constant eye on the raw material as well as the finished product.

Handling of Cream for Buttermaking.—This season many dairy companies have been collecting their supplies of cream at more frequent intervals than heretofore, and the trend is to get the cream delivered in a fresher, sweeter, and cooler condition. Also the general practice now is to proceed with the pasteurization and cooling of the cream immediately on receipt at the factory.

LIMING AND TOP-DRESSING EXPERIMENTS IN MARLBOROUGH.

OBSERVATIONS FOR 1925-26 SEASON.

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IN an article published in the *Journal* for September, 1925, it was pointed out that the soil of the Spring Creek experimental plots could safely be regarded as typical of a large number of the heavier soils on the Wairau Plain, while that of the Koromiko plots could be deemed representative of flat country in the Sounds district.

THE SPRING CREEK AREA.

The paddock on Mr. W. H. Gane's farm at Spring Creek, 12½ acres in area, was first sown down in rye-grass and red clover in March, 1923. The Department laid out plots and commenced liming and top-dressing operations during the winter of 1924. Top-dressing with fertilizers was repeated in July, 1925, but no lime has been applied since the winter of 1924, the amount then used being 2 tons per acre.

The object of this test, as was stated in the previous article, is to ascertain just how long a red clover and rye-grass paddock may be made to hold with liming and top-dressing, under the usual treatment of haying, seeding, and stocking. The common practice in the Spring Creek district (and in most districts for that matter) has been to plough up such a paddock after a period of three years. Of course, it is generally recognized that after one or two hay-cuts the rye-grass tends strongly to disappear.

The Spring Creek plots are now in their third season, one season having elapsed before any manure was applied at all. The question that remains to be solved is whether or not liming and top-dressing will enable the carrying-on of stands of clover into the fourth and successive years on a payable basis. The winter of 1924 was a dry one, that of 1925 a wet one. This has had the result that in the low-lying portions of the paddock, which are not well drained and are at the same time difficult to drain, the clover has died out. When this exception has been allowed for, it may be said that the paddock has improved materially through top-dressing. Expressed on a percentage basis, the green weights (taken twenty minutes after mowing) may be expressed as follows: If the average of the weights taken from the control plot be represented by the number 100, then the average of the limed plots equals 100; 1½ cwt. super per acre, 300; 2 cwt. super, 322; and super and lime, 356. From sixteen to twenty weighings were made from each method of treatment.

From these figures it will be seen that lime alone has so far shown no advantage; 1½ cwt. superphosphate per acre has shown an advantage of 200 per cent. over no manure, a most convincing result; 2 cwt. superphosphate per acre has shown an advantage of 222 per cent. over the untreated plots, while it also shows a suspicion of an advantage of 7 per cent. over a dressing of 1½ cwt. per acre. It is noteworthy that there was a perceptible difference in the field so far as the pro-

lificacy of growth of the $1\frac{1}{2}$ cwt. and 2 cwt. super plots was concerned. The percentage difference in weights, however, is too small to be significant. Superphosphate and lime show an advantage of 256 per cent. over the control plots, and suspicion of an advantage, again, of 10 per cent. over superphosphate alone. Most of these results, in spite of a wet winter followed by severe dry conditions in the spring, must be regarded as of quite a decisive nature. Although the advantage of super over the untreated plot in the preceding season was as much as 146 per cent., that advantage has been increased this season by about 110 per cent. over the control plot. Lime and super together last season proved of about equal value. It would seem, however, that this season there is almost sufficient evidence to enable us to say that superphosphate and lime together have proved slightly better than has superphosphate alone.

VIEW ON THE SPRING CREEK AREA.

Left—plot dressed with lime and super; right—lime alone, and control plots.

In addition to the slightly favourable evidence gleaned from weighings, it must be remarked that on the plots treated with super and lime the sward of clover was much thicker than on those treated with super alone. Moreover, rib-grass was much more prevalent on the latter. It would appear that while lime alone has shown no positive result, its use with superphosphate may be regarded as beneficial. It must be observed, moreover, that it has taken two seasons to show this result.

A second test as to the efficacy of various fertilizers was also conducted on the Spring Creek area. In this trial manures containing nitrogen seem to have shown little or no positive result, thus indicating that nitrogen is not a deficient factor in such soils so far as the establishment and maintenance of clover stands is concerned. The other manures tried were (1) ground rock phosphate, (2) a half-and-half mixture of ground rock phosphate and superphosphate, and (3) superphosphate alone—all applied at the rate of 2 cwt. per acre. If the average of weights from the control plot be represented by the

number 100, then super alone equals 271; rock phosphate with super 271, and rock phosphate alone 114.

It would appear from these results that superphosphate alone and Nauru phosphate mixed with superphosphate have given practically the same results—namely, a distinct advantage (when experimental error is allowed for at the rate of 10 per cent.) of something like 160 per cent. If allowance be made for experimental error we see that the advantage from rock phosphate alone is only slight—namely, 4 per cent. Consequently there is room for doubt as to whether or not the ground Nauru rock phosphate mixed with the superphosphate has had any part in producing the results detailed here.

Generally speaking, owing to an extremely wet winter followed by an extremely dry spring, the bulk of fodder produced was considerably less than in the preceding season, when a dry winter was followed by a wet spring.

(To be continued.)

BUTTER-BOXES MADE OF FOREIGN TIMBER.

DURING the present and the preceding season quite a number of New Zealand dairy companies have been using foreign timber for packages for export butter. Experiments and dairy-company experience have proved that butter held in many of these packages has turned out in a condition which raised no objection that has reached us. Other experiments and consignments have been less fortunate, and far too many reports have been received from London indicating that New Zealand butters packed in such boxes have been adversely affected. In these instances the taint of the wood has been imparted to the butter next to the inside of the box, and, as the period of storage extends, the taint of the timber becomes more pronounced and permeates farther into the block of butter.

There have been instances where the taint, although detectable, has not caused commercial loss. Other cases have occurred where the monetary loss has not been great, but in these instances it is doubtless the case that the prestige of New Zealand butter has been prejudicially affected. Our latest advice is to the effect that one company's butter purchased by an overseas buyer has already caused a loss running into approximately £2,000. One of the butter-boxes which contributed to this loss was returned to us from London. The timber of this box contained a number of pockets of resin which were so pronounced in odour that it was no wonder the butter had been badly tainted. One pocket, although barely discernible, and easily passed without notice, was found, when opened, to contain almost a teaspoonful of such resin or gum.

In view of the fact that there has been no particular kind of foreign timber used respecting which we have not had complaint in connection with tainting, and recognizing that the qualities of such timber imported have not evidenced that uniformly satisfactory condition which is necessary to ensure invariably satisfactory delivery of our butter in Britain, dairy companies will be well advised to give the question of purchase of butter-box material more serious consideration in future.

—W. M. Singleton, Director of the Dairy Division.

FODDERS AND SUPPLEMENTARY FORAGE CROPS FOR DAIRY-FARMERS.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, Auckland.

INTRODUCTORY.

GRASS is the main crop of the New Zealand dairy-farmer. The soils, the climate, and other natural conditions obtaining in the Dominion favour the growth of grass. The climate is mild generally, and healthy for live-stock, which can be kept all the year round in the open. With few exceptions the rainfall is good and well distributed. Over a large portion of the North Island the annual rainfall exceeds 50 in., while over the remainder it ranges between 30 in. and 50 in. The west-coast region of the South Island has a rainfall ranging from 70 in. to upwards of 100 in. a year. The eastern portion, including the Canterbury Plains (between 20 in. and 30 in.), is drier, but has a satisfactory rainfall, while the southern districts range up to 50 in. It is calculated that two-thirds of the rain falls at night, thus allowing plenty of sunshine. New Zealand is therefore favoured. Ample sunshine, copious rain, and other natural advantages combined promote the production of succulent pasture, which is the sheet-anchor of our farmers.

It is recognized that the best and cheapest food for farm animals is good grass. The area of the Dominion devoted to grassland of all classes is about 70 per cent. of the whole occupied area, while nearly 90 per cent. of the total cultivated (improved) area is in sown pasture. This is the clearest testimony of the reliance the farmer in New Zealand places on grass.

But, excellent as the best pastures are, too much reliance is usually placed on grass, particularly by the dairy-farmer. Those familiar with farming conditions know that he often exploits his grassland to a degree harmful alike to the pastures, the stock, and in turn to himself. There are certain periods when the pastures need supplementing. In mid-winter the grass is at low productivity generally, while under dry summer conditions it becomes innutritious for dairy cattle. It is thus mainly during the winter and the late summer and autumn periods that extra feed must be provided to adequately meet the requirements of dairy stock. Even on farms where the pastures are first class and the best pasture and stock management methods are practised supplementary feed is essential. Moreover, it pays to provide the extra feed.

NEED FOR MORE HAY.

As there is a surplus of grass on the pastures during the flush period an adequate quantity of hay should be saved from this excess. Farmers would do well to provide at least 10 cwt. of hay per dairy cow. Only a little over 1 per cent. of the total area of grassland in New Zealand is cut annually for hay. If all this hay were fed to the dairy cattle alone it would provide less than 5 cwt. per cow. The hay provision is thus totally inadequate. This is a matter that should receive the serious attention of our dairy-farmers. It would be difficult to beneficially replace hay with any other winter fodder.

Good meadow hay containing grasses and clovers provides a well-balanced food for stock. Temporary pastures of 25 lb. Italian or Western Wolths rye-grass with 6 lb. red clover per acre make good hay. Permanent pastures are better left for grazing. Lucerne and clover also provide hay of high feeding-quality. It may be repeated that our dairy cows need at least double the amount of hay at present saved. A provision of even 15 cwt. per dairy beast would be desirable.

WINTER ROOTS AND ENSILAGE.

In addition to hay, roots generally make up the winter bill of fare on New Zealand dairy farms. Swedes, turnips, mangolds, and carrots are chiefly relied upon. Ensilage has been coming more into favour of late years. It can to a large extent replace roots where root crops prove uncertain. Ensilage keeps well and can be fed to cows, which milk well on it during dry spells or at other times when succulent feed is scarce. There is a wide choice of crops for ensilage. Grass presents little difficulty to the beginner who wishes to try ensilage. In the many dairying districts good yields from turnips are found to be more difficult to secure, because of damage done by pests and diseases; hence the increasing attention given to ensilage.* For the same reason mangolds are being more widely grown by dairy-farmers, especially on the smaller holdings.

Where swedes can be successfully grown, particularly on the larger farms and in newly-broken-in country, they are difficult to excel. Hard-fleshed turnips sown in February or later may also be used to provide winter feed. Mangolds and carrots give a further choice of roots.

Successful mangold-growing entails labour in cultivation. The cost of producing a good crop is higher than for swedes or turnips. However, farmers should remember that the yields of mangolds per acre are heavy compared with other root crops. Mangolds resist drought well, and they can be fed through the winter and well into the spring, producing no taint in the milk. They make excellent food for dairy cows, pigs, poultry, and other stock. They are easily assimilated, and in the warmer and drier parts of New Zealand they should be grown and fed to a greater extent by dairy-farmers. They leave the ground clean for the succeeding crop.

Where soil conditions favour carrots, this crop is often grown with success. Free-working loams with a free subsoil are suitable. Carrots provide autumn and winter feed for dairy cows. Horses, especially those receiving much chaff and grain, are benefited by a ration of carrots.

Reliable authorities place the roots referred to in the following descending order as regards their feeding-value: Sugar-mangolds, carrots, ordinary mangolds, swedes, and turnips.

SUCCULENT SUMMER FORAGES.

During dry spells, frequently experienced after December, when the ordinary pastures almost stop growing and become unpalatable, green

* The subject of ensilage is treated in detail in the Department's Bulletin, No. 80, "Ensilage and Silos"; free on application.

crops are especially valuable. In the paspalum areas of the Auckland Province this grass is almost wholly depended upon to supply the necessary summer feed for stock.

In certain districts, such as Hawke's Bay and Marlborough, and under irrigation in Otago, lucerne thrives particularly and can be grazed. In other places, where lucerne can be grown only with careful attention to approved methods of maintenance, it can be cut three to four times in the season. It therefore supplies green feed and hay, and the early cuts provide silage, each and all of which have a valuable place on the farm. The high nutritive quality of lucerne is widely known. For the average dairy-farmer whose farm is well improved, lucerne should certainly occupy an area of 5 to 10 acres or more, according to his requirements. Green lucerne should be wilted before being fed. Where grazing is practised, it should be grazed after milking and only for short periods. Stock should not be put on when it is wet. In dry weather ensilage, already referred to, provides good fodder relished by stock. It causes no taint if fed properly.

There is a wide range of crops which can be grown to supply summer feed. Stock like variety; it not only helps to ensure good health but greater production. The crops to be grown must be selected according to the requirements of the farm and with due attention to local conditions. The district, its climate and the soil, will influence to a large extent the choice of crops.

NOTES ON FORAGE-CROP PRODUCTION.

It must be understood that the information and advice relating to forage crops which follows is of a general character. Individual farmers, with their local knowledge, may have to modify the amounts of seeding or the manurial prescriptions given. However, the notes should prove helpful to many farmers and others who wish to have some practical guidance.

With good, well-managed pasture there is an increase of the humus in the soil, and the upkeep of soil-fertility is an easy matter; but so soon as land is devoted to cropping a loss of fertility may quickly ensue unless attention is devoted to the principles and practices of good tillage. In preparing an area for cropping the soil selected should have satisfactory drainage. If a pasture is to be broken up it is often found convenient to take a grass sward which is run out. Better results will be gained from a pasture in good heart, with plenty of clover in it. More humus is provided by the extra organic matter in the turf. This adds to the fertility of the soil, helping in retaining soil moisture for the crop, improving the texture, and giving a source of nitrogen.

Where the soil is at all heavy in nature early preparation is particularly advised. Regarding the actual time to plough the soil, no hard-and-fast rule can be laid down. The seasonal rainfall will largely determine it, especially on soils which set hard. Discretion must be used, especially if the season is wet and the soil heavy. Lighter soils, which may be worked at almost any time, present no great difficulty and do not need long fallowing. If the soil is turned up and allowed to lie exposed to the weather during the winter months much good will result. If a second ploughing is to be done, the first

one should be shallow. On lighter soils ploughing in the spring is time enough. Such soils leach if laid up to the bare fallow where rainfall is copious. If ploughing is done early a catch-crop is advisable, as it makes ready use of the soluble foods in the soil. Where twitches have to be eradicated well-worked fallows are necessary to clean the land.

Attention should be given to approved rotational methods and thorough preparation of the seed-bed. Liming is often found beneficial. It corrects sourness and provides a base for useful small forms of life in the soil, while legumes and other crops with a high lime-requirement benefit greatly where lime is applied. Burnt lime is useful for improving the physical condition of heavy soils.

Too heavy a sowing often gives much poorer results than a light seeding, as the plants, being too close together, become stunted. Heavy land will require more seed than light land. In a loose seed-bed more seeds become buried and fail to germinate than in a well-consolidated one. The superior crop seen on the headlands can often be ascribed to no other reason than the better consolidation of the seed-bed there. Often the partial failure of a crop is due to faulty preparation of the land, and the need for thorough and early cultivation and a well-consolidated seed-bed free from air-spaces, undecayed vegetable matter, and large clods cannot be emphasized too strongly.

In the matter of manures only a general outline can be given. The mixtures mentioned are only for general conditions, and must be suited to local needs. The necessity for nitrogen in the manure often depends on the quality of the soil, more being required on one poor in vegetable matter than one rich in that ingredient. In many places, especially on light soils, much of the superphosphate recommended can be replaced by basic super and bonedust.

MANGOLDS.

Mangolds will thrive on most soils other than those of a thin, hungry nature. They thrive best in deep loams well supplied with vegetable matter. Clay loams give good crops provided they can be brought to a fine seed-bed.

Mangolds do well after grass, owing to the large amount of vegetable matter stored in the soil. A pasture as free as possible from weeds should be selected. The cultivation must be early ~~and thorough~~ to have the vegetable matter well decayed and the seed-bed well consolidated before sowing. The usual procedure is to plough early in the winter and cross-plough again in the early spring. If the ploughing out of grass is left till early spring the turf must be thoroughly broken up, a month or two before ploughing, by heavy disk harrows or a disk plough. On heavy land it is often a good practice to plough in the autumn, set the land up in ridges, and allow it to weather during the winter; then cultivate, roll, and work down to a seed-bed in spring. Liming with burnt lime assists in promoting tilth under such conditions.

The usual sowing is 4 lb. per acre of seed having a germination of 130 to 140 per cent. The "seeds" being really fruits, the crop must be hand-thinned. The practice sometimes followed of raising plants in a seed-bed and planting out later helps in giving the crop a clean start free from weeds.

Varieties : Long Red is a heavy cropper and is suited to heavy land ; also it is the hardiest sort, but does not keep as well as the globe varieties. Yellow Globe and Prizewinner Yellow Globe are standard varieties. These give a good yield and keep well. Golden Tankard gives a medium yield and is very nutritious. New Sugar is a nutritious variety, while Jersey Queen is a popular one. White Knight is a variety coming into favour. It is a good practice to sow alternate rows of long red and globe varieties.

It is often the practice to steep the seed in soft water for ten to twelve hours, then allow it to dry for another ten hours before sowing. This gives good results, provided the ground is not very dry at the time of sowing, in which case the seed germinates with the absorbed water, and, there not being sufficient moisture in the soil to carry the plant on, it often dies. If uncertain of the weather it is well to sow 2 lb. of soaked seed and 2 lb. of dry seed.

Sowing is best done in October, in wide drills, either on ridges or on the flat. The distance usually varies from 24 in. to 30 in. On heavy land the combined ridger and sower brings the clods to the top of the ridge, where they form a bad seed-bed. In this class of land it is better to set up ridges with a potato-ridger (double mouldboard plough), sow half the manure in the bottom of the ridges, and split the latter back over the manure, then sow the seed with a combined ridger and sower having the disks removed. When sowing on the flat, broadcast half the manure and sow the other half with the seed.

Any well-rotted stable manure available should be applied to the land before ploughing. Artificial fertilizers should be used at the rate of 4 cwt. to 6 cwt. per acre. On a small area intensely cultivated a slightly heavier dressing would be beneficial. For a deep loam well supplied with lime the following mixture would give good results : Superphosphate, 4 parts ; sulphate of ammonia, 1 part ; kainit, 2 parts. On light soils half the superphosphate could well be replaced by bonedust or blood-and-bone. If kainit is not used, 3 cwt. to 5 cwt. of agricultural salt should be applied before sowing, and sulphate of potash or some other potash salt used in the mixture.

Mangolds respond well to intercultivation with the horse-hoe. If they are grown on ridges it enables the work to be commenced much earlier than when planted on the flat.

Before feeding, mangolds must be lifted and stored in a pit to ripen. If fed while still growing or in an unripened state they are liable to cause scouring. In many instances, also, serious cases of tympany and abortion have occurred, allegedly due to feeding green mangolds. If the roots are not pitted they must be pulled and allowed to lie for at least a fortnight before feeding. To be quite safe, a month is necessary for dairy cows and six weeks for pigs. It is advisable to pull the tops off and leave them in the field, as they are of poor feeding-value, though they contain considerable amounts of manurial constituents. The tops from an average crop of mangolds contain as much fertilizer as is contained in 4 cwt. to 5 cwt. of blood, 1½ cwt. sulphate of potash, and 1 cwt. superphosphate.

When pulling mangolds care must be taken not to break them or they will bleed. For the same reason the tops should not be cut, but twisted off as the mangolds are pulled.

For feeding, 40 lb. to 50 lb., together with hay, is a sufficient ration. In the spring, if the mangolds in the pit happen to be growing, they should be fed carefully.

The general principles for the cultivation of other root crops are much the same as for mangolds, with the following particular differences :—

CARROTS.

Carrots make a splendid forage for milking-cows in the late autumn and early winter. Best results are obtained from a deep sandy loam with a free subsoil.

If sown in 14 in. drills and unthinned 1 lb. of seed is sufficient. In 21 in. or 28 in. drills sow 2 lb. to 4 lb. of seed and hand-thin. It is a good plan to mix the seed with damp sand several days before sowing, to stimulate the seeds to germinate and so get ahead of the weeds. The crop should be sown at the same time as mangolds, and be inter-cultivated. The same manurial mixture as for mangolds can be used, with half part of sulphate of potash substituted for the kainit.

Red varieties are slightly more nutritious than the white ; Sinclair's Champion and Magnum Bonum are those usually sown. Among white varieties, White Belgian grows high out of the ground and is a heavy yielder ; Matchless White is a heavy yielder and easily lifted.

A ration of 30 lb. to 35 lb. of carrots per beast per day is sufficient. Carrots keep well in the ground.

TURNIPS AND SWEDES.

Turnips and swedes do well in most soils, but are best suited to good loams. Acid conditions in the soil encourage club-root disease.

Turnips usually follow grass, and the land should be ploughed early (June or July) and worked down to a fine well-consolidated seed-bed before sowing.

White turnips are sown from October to March. For February and March feeding sow at the end of October or beginning of November. Imperial Green Globe is the best variety for general purposes ; Purple-top Mammoth, Devonshire Greystone, Red Paragon, and Lincolnshire Red Globe are quick growers for early use.

Yellow-fleshed turnips are sown from November to February. The yellow-fleshed varieties are more robust, slower in growth, and of superior feeding-value to white turnips, but they do not stand dry conditions as well. Green-top Aberdeen is a handy sort and a good keeper ; Purple-top Aberdeen is grown for early use.

Swedes are sown from November to January. Superlative is one of the best varieties—a high yielder, good keeper, and of excellent feeding-value ; Elephant, Champion, John Bull, Best of All, and Magnum Bonum are good standard varieties. Sowings are as follows : Drilled in 14 in. rows, 8 oz. to 12 oz. ; ridged in 28 in. drills and thinned, 1 lb. to 2 lb. ; broadcasted, 1 lb. to 2 lb. per acre.

Phosphatic manures are essential for turnips and swedes, and part at least of the phosphates should be soluble. Superphosphate is particularly good because it contains sulphur, which is beneficial to turnips, in addition to soluble phosphate. For soft turnips on good loams use 1½ cwt. to 2 cwt. basic superphosphate ; on poorer and

lighter soils, $1\frac{1}{2}$ cwt. to 2 cwt. basic super and 1 cwt. bonedust. Swedes may be given the same manures as for turnips, but they require 1 cwt. to $1\frac{1}{2}$ cwt. more per acre.

Swedes and turnips should be fed off in breaks. The average requirements are about $\frac{1}{2}$ cwt. per head of cattle per day. When feeding to cows in milk the turnips should be pulled the previous day, allowed to wilt in the sun, and fed out in a clean grass-paddock immediately after milking. Wilting for a day and a half is best. For cows, 30 lb. to 40 lb. a day is sufficient. Overfeeding of turnips is the main cause of taint in milk. Another cause is feeding diseased turnips, especially where cows are turned on to the crop.

RAPE.

Conditions regarding cultivation are similar to those for root crops. Rape has a deep tap-root which goes into the subsoil, thus improving it for subsequent crops. This crop can be used on the dairy farm mainly for pigs, or to cows not milking. Most crops, especially grass, do well following rape. It does well on most soils, but best on good loams; it is usually taken after grass.

Sowings are as follows: In 7 in. drills, $2\frac{1}{2}$ lb.; in 14 in. drills, 2 lb., per acre. Dwarf Essex and Broad-leaved Essex are suitable varieties. The time of sowing depends on the time when the stuff is required. The first sowing should be three and a half months before it is needed for grazing.

Fertilizers should be selected according to the quality of the soil. A freezing-works mixture having a composition of about 2·5 per cent. insoluble nitrogen, 10 per cent. soluble tricalcic phosphate, and 20 per cent. insoluble tricalcic phosphate, at the rate of 4 cwt. per acre, should have good results. About 4 oz. to 8 oz. per acre of mustard should be sown with rape.

KALES.

The cultivation, manuring, &c., of kales is similar to rape, but they should be sown in 28 in. drills and intercultivated.

Thousand-headed kale is more a holding than a fattening crop, providing a large amount of feed in summer, autumn, and early spring. Before feeding off in the spring, on land that is at all heavy, the crop should be moulded up to prevent the stock puddling the land and making it consolidated.

Buda kale is slightly more nutritious than Thousand-headed kale, but lighter in yield.

Chou moellier or marrow-stemmed kale is a giant, thick-stemmed kale, growing 4 ft. to 6 ft. high. There are two varieties, Green-stemmed and Purple-stemmed. It does not give as much feed as Thousand-headed kale, but it is quite a nutritious crop. It should not be fed to dairy cows in milk if rotten leaves are on the stems, as they cause milk-taint. It is best cut, wilted, and fed out to the herd.

CEREAL MIXTURES.

Cereals such as oats, barley, rye-corn, &c., provide good supplementary feed. Short green oats particularly, and oats mixed with a

legume or Skinless barley, provide excellent winter and early spring grazing for milking-cows before the grass comes away.

For these crops the land should be ploughed during December, and a thorough cultivation should be given during February and March with the disks, cultivators, harrows, and roller. The land should be worked until in fine tilth and really good order for sowing the seed. Under ordinary conditions this will be about the first week in April, or as soon as there is sufficient moisture in the land to ensure a good germination.

The following combinations and sowings per acre are recommended, according to local conditions :—

John Brown wheat, 90 lb. ; Scotch tares, 60 lb.
Purple-straw Tuscan wheat, 90 lb. ; Scotch tares, 60 lb.
Emerald rye-corn, 55 lb. ; Marquis wheat, 58 lb.
Emerald rye-corn, 87 lb. ; Scotch tares, 60 lb.
Algerian oats, 45 lb. ; Emerald rye-corn, 55 lb.
Algerian oats, 45 lb. ; Brown Skinless barley, 40 lb.
Algerian oats, 45 lb. ; Major wheat, 58 lb.
Algerian oats, 55 lb. ; Scotch tares, 60 lb.

For manure, use from 2 cwt. to 3 cwt. of superphosphate or basic superphosphate per acre. Add 1 cwt. of blood-and-bone where the soil-quality is not good.

These forages can be grazed, or they may remain to be cut and carted out to stock as required. Any balance of the crops not required for feeding can be utilized for ensilage, chaff, or hay, and will be found equally valuable for feeding to stock during the month of January following, or at any other time when required. An exception must be made in the case of rye-corn, which, when approaching maturity, becomes too tough for haying purposes. Cape barley should not be fed off after it comes into ear.

MAIZE, SORGHUM, AND MILLET.

These crops have their place, especially in the warmer parts of New Zealand. The cultivation and manuring given for rape should be followed, using 2 cwt. to 4 cwt. of the mixture mentioned ; or a mixture of blood - and - bone and super would have much the same composition. For late March, April, and May feeding, one or more of the crops in question should be sown at the end of November, and cut and carted out as required.

Maize provides good feed for cows, especially for putting the herd into a good condition to face the winter. Sow at the rate of 30 lb. to 60 lb. in 28 in. drills, or broadcast at the rate of 2 bushels per acre. Drilling is preferable, as it allows for intercultivation, which, under dry conditions, ensures a heavier yield. The seed should be sown at a depth of 1½ in., and guarded against birds. Suitable varieties are Hickory King, Ninety Day, and Early Red Leamington.

Sorghum is sown at the rate of 25 lb. per acre in 28 in. drills or broadcast. Suitable varieties are Planter's Friend, Early Ambercane, and Sorghum Saccharatum. Sorghum requires less moisture than maize to produce a satisfactory crop. This fact of drought-resistance should be borne in mind by farmers. Its cultivation is confined to

the warmer parts of the North Island. The same applies to Sudan grass. The only safe time for feeding off sorghums is at the full flowering stage. Stunted or frosted sorghum should not be fed.

Japanese millet is a good crop for dairy cows during dry autumn weather. It can be grazed when 6 in. to 9 in. high in breaks, or cut and fed out in the field. It does well when combined with red or crimson clover. By itself, sow 15 lb. to 20 lb. of seed per acre in 7 in. drills ; or 10 lb. of millet with 8 lb. of clover.

CATTLE MARROWS AND PUMPKINS.

These are often used by dairy-farmers for winter feed. Sowing is at the rate of 2 lb. to 4 lb. in rows 6 ft. apart, which should be done as soon as the danger of frosts is over, usually about late October or November. Marrows are sometimes sown broadcast. Both pumpkins and marrows may be sown between the rows of maize, where this crop is usually grown. Field varieties include Mammoth cattle pumpkin and kumikumi. They can be fed on the ground like turnips, or, when mature, stacked and carted out and fed on the pastures.

SUMMARY.

(1.) Grass pasture alone, at certain periods, is inadequate for dairy cows.

(2.) Pasture must be supplemented by suitable fodders and special crops at lean periods.

(3.) The surplus grass in the flush can be made into hay and ensilage, which supply feed when a shortage comes.

(4.) More hay should be saved in New Zealand, and a wider use of ensilage would be a sound and beneficial practice.

(5.) Roots are the winter mainstay, but silage can to a greater or lesser extent replace roots where the growth of the latter is uncertain.

(6.) Succulent summer forages should, where found necessary, be grown and fed.

(7.) Good cultivation, attention to manuring, and other related matters on the productive side of cropping ensure successful crops.

In conclusion, it may be added that as the dairy cow has been aptly called the foster-mother of mankind she should at least be sufficiently fed at all times. The best cow can only do its best when adequately fed, and it pays to do this.

Infected Area at Waitara.—In connection with the discovery of cattle-ticks, the area of land at Waitara declared an infected place under the Stock Act has been extended, and is now defined as follows : All that area bounded by a line commencing at the sea at the mouth of the Waiongona River, following that river to the bridge on the Te Arai Road ; thence by that road to its junction with the Waitara Road ; thence by the Waitara Road to its junction with the Pennington Road ; thence along that road to corner of Section 35 ; thence along the south-eastern boundary of Sections 35 and 36 to the Waitara River, across that river to the Waipapa Road ; thence along that road to Elliott Road ; thence by the south-western boundary of Subsection 2 of Section 41 ; thence by the southern boundary of Section 97 to the Nikorima Road ; thence in a northerly direction along that road to the sea ; and thence by the seashore to the mouth of the Waiongona River.

C.O.R. CLOSING LIST FOR YEAR 1925.

Dairy Division.

THE appended list, which completes the publication of records for purebred dairy cows which gained certificates in 1925, contains particulars of many performances worthy of special mention, but space restrictions preclude much comment.

It may be mentioned, however, that the cow Jewel's Mystery, which appears at the head of the Jersey mature class with 809·70 lb. butterfat, has three previous certificates of record, one of them being on a production exceeding 800 lb. butterfat. She was bred by Mr. J. F. Vosper, Matamata, in whose hands she gained her first two certificates. For some years, however, she has been owned by Mr. A. E. Watkin, of Takanini, and, through her progeny, should aid considerably in the making of the fine herd which this owner is rapidly developing.

Another outstanding individual in the present list is the mature Ayrshire, Sheilah's Favourite of Allandale, owned and tested by Mr. R. S. Weir, of Seaward Downs. Her record of 697·86 lb. butterfat entitles her to a place among our higher producing C.O.R. Ayrshires.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Hui Mai Glorina	J. Nicholson, Manakau	1 359	240·5	365	10,818·6	523·56
Craigalea Bonnie	J. G. Robertson, Eltham	2 4	240·9	365	8,706·5	494·71
Kelvin Belle	G. Buchanan, Paeroa	2 51	245·6	365	7,787·0	423·86
Raithwaite Favourite Belle	H. H. Buxton, Auroa	1 321	240·5	365	6,871·9	401·99
Meadowvale Devotion	E. O'Sullivan and Sons, Tariki	1 279	240·5	365	7,998·2	395·12
Tirohia Starlit	B. E. Veale, Tirohia	2 46	245·1	363	6,553·0	386·07
Twylish Mayflower	S. Shalfoon, Opotiki	2 39	244·4	365	6,609·5	385·03
Kelvin Velvet	G. Buchanan, Paeroa	2 40	244·5	365	6,775·8	382·05
Raithwaite Maid Molly	H. H. Buxton, Auroa	1 332	240·5	315	7,311·8	372·88
Grey Lady	S. Shalfoon, Opotiki	1 359	240·5	355	5,931·6	350·57
Holly Oak Beulah	Fred Phillips, Otorohanga	1 289	240·5	319	6,078·9	342·13
Waipuna Lena	H. C. Wallace, Tamahere	2 25	243·0	365	5,469·8	325·46
Raithwaite Charm's Lass	H. H. Buxton, Auroa	1 315	240·5	311	6,178·4	316·86
Rosehill Choice	W. C. S. Hosking, Waiuku	1 342	240·5	342	5,644·4	315·44
Tirohia Golden Emblem	B. E. Veale, Tirohia	1 364	240·5	339	5,549·5	281·28
Senior Two-year-old.						
Tirohia Superior	B. E. Veale, Tirohia	2 325	273·0	365	7,379·7	473·73
Wattle Berry	F. C. Ross, Kiwitea	2 339	274·4	365	6,005·2	336·73
Jocular Beauty	W. S. Carter, Palmerston North	2 313	271·8	365	5,968·0	328·96
Willowbank Lady May	Boon Bros., Whakatane	2 114	251·9	256	5,058·5	284·73

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Majesty Mahone ..	C. Stevens, Maungatapere	3 194	296·4	352	9,439·2	556·72
Silver Glance ..	Brakenridge and Pearson, Taupaki	3 45	281·5	365	8,406·4	512·56
Marchioness Patricia	G. Hodgson, Whakapara ..	3 71	284·1	365	10,188·8	469·02
Huimai Nancy Jean..	J. Nicholson, Manakau ..	3 45	281·5	336	7,747·0	461·39
Pine Grove Lily ..	John Luke, Clevedon ..	3 12	278·2	364	8,111·3	438·27
Golden Wattle ..	F. C. Ross, Kiwitea ..	3 40	281·0	304	6,705·5	403·02
Brooklyn Mary ..	H. J. Lancaster, Glen Oroua	3 305	307·5	365	8,168·0	401·91
Eileen's Winning Way	Brakenridge and Pearson, Taupaki	3 293	306·3	365	6,208·4	370·15
Lady Dudu ..	A. E. Watkin, Takanini ..	3 326	309·6	275	6,665·7	360·79
Four-year-old.						
Bellewattle.. ..	F. C. Ross, Kiwitea ..	4 341	347·6	337	7,969·5	427·09
Mature.						
Jewel's Mystery† ..	A. E. Watkin, Takanini ..	11 352	350·0	359	12,834·9	809·70
Charm's Lord's Fancy	G. Buchanan, Paeroa ..	7 141	350·0	365	12,270·7	581·42
Reid Park's Lizzie ..	W. C. S. Hosking, Waiuku	7 282	350·0	355	9,506·5	560·86
Basra	C. Stevens, Maungatapere ..	7 216	350·0	365	10,789·4	560·47
Lakeside Calm ..	V. W. Nowell, Hawera ..	6 346	350·0	365	8,952·8	515·32
Rata Bloom ..	B. E. Veale, Tirohia ..	6 292	350·0	365	8,805·2	507·08
Kentucky	K. M. Stevens, Maungatapere	8 318	350·0	350	9,431·4	505·16
Waipiko Priscilla ..	J. C. Hare, Cheltenham ..	6 25	350·0	365	10,805·4	495·43
Maxim's Maid Cherry	C. Stevens, Maungatapere ..	8 58	350·0	338	6,728·0	409·31
Butterman Banker ..	H. J. Lancaster, Glen Oroua	9 41	350·0	312	7,571·6	369·75
Lucky Dorothy Begonia	K. M. Stevens, Maungatapere	9 114	350·0	273	6,080·4	352·22
	FRIESIANS.					
Junior Two-year-old.						
Johanna Ormsby ..	W. Barton, Featherston ..	2 163	256·8	363	12,190·3	438·89
Senior Three-year-old.						
Queen Hengerveld Belle of Groteholm†	W. H. Staniland, Clandeboye	3 218	298·8	365	11,038·2	441·14
Junior Four-year-old.						
Ellesmere Eding Lassie†	W. H. Staniland, Clandeboye	4 120	325·5	346	11,483·5	437·86
Senior Four-year-old.						
Peria Claudia 1st ..	J. H. Wilson, Matamata ..	4 357	349·2	323	12,024·5	462·66
Mature.						
Rosevale Kittie Posch*	H. North and Sons, Omimi	6 0	350·0	365	22,690·4	713·97
Woodcrest Netherland Pauline†	Riverlea Land Syndicate, Hobsonville	7 88	350·0	365	18,656·2	650·02
Marlo Belgian Lassie	J. H. Wilson, Matamata ..	9 341	350·0	310	17,247·6	538·46
Selwyn Colantha Lass	W. H. Staniland, Clandeboye	6 39	350·0	347	12,771·9	451·22
Manola Empress* ..	Matangi Friesian Farm Co., Matangi	8 65	350·0	199	10,492·9	442·07
Dutch Juno* ..	Matangi Friesian Farm Co., Matangi	5 88	350·0	213	12,238·0	422·73
Hengerveld Belle Segis†	Riverlea Land Syndicate, Hobsonville	10 28	350·0	324	10,551·8	374·76

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
MILKING SHORTHORNS.						
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Pine Farm Letty 2nd A†	J. Parkinson, Opotiki ..	2 101	250·6	365	10,402·8	373·16
Willowbank Tangi's Milkmaid 3rd	J. W. Robinson, Runciman	2 23	242·8	340	7,584·2	328·21
Willowbank Tangi's Beauty 2nd	J. W. Robinson, Runciman	2 48	245·3	334	7,167·3	306·73
Willowbank Tangi's Favourite 2nd	J. W. Robinson, Runciman	1 279	240·5	325	6,583·9	286·57
Three-year-old.						
Willowbank Tangi's Wincy	W. H. Simms and Son, Christchurch	3 14	278·4	305	11,790·5	498·93
Mature.						
Pukekite Rangi* ..	R. King, Buckland ..	..	350·0	269	13,365·1	621·71
Pukekite Queen* ..	R. King, Buckland ..	..	350·0	313	11,807·8	498·51
AYRSHIRES.						
Four-year-old.						
Ivanhoe Dairymaid*	A. M. Weir, Menzies Ferry..	4 28	316·3	320	11,737·3	436·01
Mature.						
Sheilah's Favourite of Allandale*	R. S. Weir, Seaward Downs	9 339	350·0	365	15,206·2	697·86
Little Nell of Frewdale*	A. M. Weir, Menzies Ferry	6 10	350·0	365	13,413·2	563·80
Perfection of Ivanhoe*	A. M. Weir, Menzies Ferry	6 339	350·0	365	13,372·0	549·62
Molly Bawn of Ivanhoe*	A. M. Weir, Menzies Ferry	7 1	350·0	365	12,578·6	511·62
Myra of Townhead*	R. S. Weir, Seaward Downs	6 329	350·0	365	11,712·5	502·60
Ivanhoe Brownie* ..	A. M. Weir, Menzies Ferry	5 28	350·0	324	10,587·5	386·90
Iris 4th of Townhead*	R. S. Weir, Seaward Downs	6 311	350·0	267	9,473·0	380·66
Ivanhoe Miss Russell 2nd*	A. M. Weir, Menzies Ferry	12 13	350·0	364	12,720·8	487·66
RED POLLS.						
Two-year-old.						
Dominion Lady Lallah	Central Development Farm, Weraroa	2 10	241·5	327	6,442·0	284·42
Three-year-old.						
Dominion Table Top	Central Development Farm, Weraroa	3 346	311·6	333	9,185·6	410·39

Second-class Certificates.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
Jerseys.						
Four-year-old.						
Waipiko Clarissa ..	C. G. C. Dermer, Cheltenham	4 344	347·9	365	11,160·6	641·85
Milking Shorthorns.						
Junior Two-year-old.						
Glenthorpe Daisy 3rd†	A. J. Melville, Buckland ..	2 71	247·6	365	10,220·8	506·95

SEASONAL NOTES.

THE FARM.

PASTURE TOP-DRESSING AND HARROWING.

WHERE the slower-acting phosphates, such as basic slag or any of the ground rock phosphates, are preferred, these should be applied as soon as possible if an early spring effect is to be obtained. On the other hand, where superphosphate is preferred and carting is difficult in early spring, or weather conditions unsuitable for application, super can be spread at any time during winter. The idea that phosphates wash or leach out is an erroneous one, as has been proved very conclusively.

Phosphatic fertilizers, also lime, are the first essentials on most New Zealand soils, and until the supply of these has been built up in the soil the use of either potash or nitrogen is a secondary consideration. Of the phosphatic fertilizers available the different forms are relatively valuable under varying conditions. Thus superphosphate, either mixed in the form of basic super or applied separately, is suitable for the drier soils, while basic superphosphate is especially good on soils of a peaty nature. Basic slag is advised for use on the heavier moister soils, and also on the stiffer volcanic soils, where it has given excellent results. Basic slag is also particularly good in building up worn-out pastures. Nauru rock phosphate as an autumn top-dressing has given good results on many soils in the North, especially stiff clays and other soils of a sour nature. It is especially useful where lime is costly and the cartage a heavy charge. A mixture of superphosphate and Nauru, either half and half or two of Nauru and one of super, is an improvement on plain Nauru, and makes an excellent general top-dressing for pastures where lime is lacking and is difficult or costly to apply. Suitable dressings of the various fertilizers, or mixtures, range between 2 cwt. and 4 cwt. per acre.

Both basic slag and a mixture of superphosphate with lime promote the growth of white clover, and are therefore particularly valuable in producing the best type of feed for ewes and lambs.

The coming month is a very good time for tripod-harrowing old pastures. The thorough harrowing of grassland periodically is one of the most important factors of pasture-management. It is observed that in many instances a light harrowing is considered sufficient so long as the animal-droppings are scattered; whereas one of the main objects—the invigorating of the old turf—can be effected only by thoroughly breaking the surface.

LIMING.

Lime, like the slower-acting fertilizers, is best applied in the autumn, so that it may become thoroughly incorporated with the soil during winter, and in a manuring scheme is of special value for preceding superphosphate. Lime is often applied in the hope that it will make wet land drier. This is a great mistake and a waste of good

material, for such land must first be efficiently drained before any good effect can be expected either from lime, manures, or cultivation. Where liming is not intended to be repeated in the near future, ground limestone should be applied at not less than 1 ton per acre, or ground burnt lime at from 10 cwt. to 12 cwt., on average soils. If an application is to be made every two or three years, however, dressings of from 6 cwt. to 10 cwt. per acre are quite satisfactory—in fact, are generally preferable to heavier applications at longer intervals.

AUTUMN SOWING OF OATS.

April and the early part of May is a good period for sowing oats for threshing or chaff, as the crop gets well established during the winter and is in a condition to make very rapid growth in the early spring. Oats sown at this period should provide one or two good feedings in the spring, and be ready to harvest from the middle to the end of December. Sowing should be at the rate of 2 bushels to 2½ bushels per acre. In the case of Algerians it is advisable to use seed produced the previous season, as new seed is often of low germination. Suitable manures are super or special grain mixtures at from 1 cwt. to 2 cwt. per acre.

In preparing the seed-bed for autumn-sown cereals the land should be worked to produce a good mould underneath, but the surface left rough. The clods provide shelter for the young plants during the winter and prevent the soil from running together too closely. The lumps can be broken down when harrowing in the spring to break the crust formed by feeding off and winter rains.

Loose-smut of oats is controllable by pickling, and the trouble is well worth while if the seed is not known to be clean. One method of proved worth is the following: Soak half-sacks of grain for seven minutes in diluted formalin solution—1 pint of commercial (40 per cent.) formalin to 50 gallons of water; allow to drain; and dry slowly. Sowing should be done the following day.

OAT VARIETIES.

The following notes may be useful as a guide to the selection of an oat suitable for its particular purpose and for district conditions:—

Garton: Garton's Abundance may be regarded as the best yielder and miller in New Zealand, and is the best all-round oat for the South Island, as Messrs. Garton are continually improving the strain. Gartons should not be fed off in the same way as Algerians and Duns. Generally, they should be fed off once only with a big mob for three to four days, and then the sheep taken away. If Gartons are fed otherwise the sheep tend to eat in patches and kill out some parts previously grazed, while other parts grow rank. Garton's Leader is popular in the Timaru district, but of recent years it has largely given way to Garton's Abundance.

Algerian: This variety is best sown in autumn. Popular as green feed; flag fine, abundant, and highly palatable, being preferred to Gartons by stock. Can be fed two or three times in autumn and spring. If it is to run to a grain crop, care should be taken not to feed too late. Canterbury-grown seed is always in demand in the

North Island for green feed. The grain-yield of Algerians is good, but the milling-qualities poor. The straw and chaff, however, are considered very palatable.

Dun: These must be sown in the autumn. The plant has fine leaves and a very spreading habit, so that the green feed tends to get dirty and be wasted. It makes very little growth until about early September, and then can be fed repeatedly till the end of October. The straw is fine and weak. The heads ripen from above downwards, so that the tip grain shakes while the straw is still green. The crop should be cut at first shake. The yield is high in good circumstances. The grain is in demand for racehorses.

Black Tartar: Best autumn-sown. Green feed plentiful, but not very palatable. Straw tall, coarse, and strong. Yield high on good ground, but falls off very rapidly on light land or in dry weather. Chaff is generally considered good.

Danish: This variety has an old Canterbury reputation as a good green-feed and chaff oat.

Potato, or Canadian: Can be sown in late spring, ripening under four months from sowing. Flag broad; cannot be fed off at all. Good milling-qualities and high yield, but rusts badly and shakes easily.

Ruakura: Should be autumn-sown. Green feed abundant. It is highly rust-resistant in some parts of the country, and is popular in several North Island districts, but is not favoured generally in Canterbury.

Sparrowbill: Spring-sown; grown chiefly in Otago. Broad flag; must not be fed off. Straw coarse, but head so heavy and compact that it often breaks about 18 in. from top. Milling-qualities good, and yield very heavy. This variety is mostly being replaced by Gartons.

Black Excelsior: Suitable for spring or autumn sowing. Tillers very little. Produces a thin crop even if sown thickly. Straw coarse and short, but very palatable. Yield of grain low.

IRRIGATION FARMING.

Where irrigation farming is practised in Central Otago every endeavour should be made during April to break up land intended to be sown in the spring. On dairy farms within the next month an area should be sown in Emerald rye-corn, at 2 bushels per acre, to provide early spring feed.

From now on preparations should be made to have contour ditches cut, leading water to those places in the various paddocks which during the past season have proved hard to irrigate; this particularly applies to undulating country. Low-lying parts of the paddocks which become flooded during the irrigation season should have open drains cut, so as to allow surplus water to be carried off to lower levels. Ditches can now be cleared while still soft, and all boxes which have become disrepaired during the season should have attention.

On low-lying more or less flat country which has not previously been brought under irrigation, ploughing and preliminary levelling should be carried out with a view to laying out the land in a series of

checks for border-method irrigation. This method requires well-levelled land, and much can be done in respect to such levelling at the time of autumn ploughing.

POTATOES.

From now on the main crop of potatoes will be ready for lifting, before winter rains set in. The tubers should be carefully sorted, and those intended for marketing later pitted dry on a well-drained piece of land, the pit being well thatched to keep out frost and winter rains. Potatoes intended for seed should be stored in a cool, dry, well-ventilated shed. The gratings in a wool-shed make an excellent floor for potato-storage.

—*Fields Division.*

THE ORCHARD.

EXPORT TRADE.

PICKING of the later varieties of apples will be engaging the attention of growers at this time, as the fruit has been maturing very fast. Every endeavour should be made to get the fruit away as soon as ready for picking. The safest course is to have all varieties on the water before the end of April. Should the season be an early one in the Northern Hemisphere our fruit would then be sold before the new fruits became plentiful. The Australian States and Tasmania are shipping heavily to overseas markets this season. The quantity of late varieties will probably be a record, and the experience of the last two seasons has been that the latest arrivals have not been so satisfactory to some growers as they expected. In some instances growers have themselves to blame, as the assembling has been too protracted. This year every effort should be made to get the fruit packed up to time, and so eliminate the risk of faulty condition on arrival at destination and the overlapping of the new season's fruits in Europe which was so detrimental to the sale of some of our late varieties last season.

STORAGE OF FRUIT FOR LOCAL MARKETS.

Growers should now give attention to the storage of apples for their local trade. The successful keeping of fruit over long periods is governed by the care taken to ensure this. The fruit must be picked as soon as matured, and placed in the cool store as soon after picking as possible. All fruit showing stem-punctures, insect-bites, and other injuries should be rigidly discarded from the cool-store pack. It is advisable not to wrap fruit for cool storage. Pack carefully, and fill the case well without bruising, and it will be found that upon packing out with paper later on there will be a gain in the number of cases for market, providing storage has been successful. It is not economical to pay storage on wrapping-paper, and the repacking is much quicker when dealing with unwrapped fruit.

Fruit intended for ordinary storage should be graded for quality and sizes as soon as picked, and stacked separately where it will be available when needed for order or auction. The large or faulty fruit can be dealt with first, thereby reducing waste to a minimum.

Be careful to keep out any fruits likely to rot; otherwise not only will the faulty fruit be lost but also several adjacent to it.

SPRAYING; COVER-CROPPING.

Late varieties of apples can be sprayed with lime-sulphur or bordeaux previous to picking for late storage, as a preventive of ripe-rot, bitter-rot, and black-spot development, &c. Cases should be treated similarly, where these have become soiled with rotting or diseased apples, before storing fruit away in them.

In orchards where the land is suitable for sowing beans, peas, or vetches for cover-crops, this work may still be carried out.

—*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

Seasonal work for the coming month in orange and lemon groves will be to thoroughly stir the land and clear it of weeds. Trim the lower branches of the trees so that none will be left to sweep the ground — a condition which favours the spread of lemon brown-rot. Spray with bordeaux, 4–4–40, as a precaution against this disease, followed by oil, 1–60, for scales and mites. If this latter spray is not applied before growth ceases for the season there will be danger of defoliation in the winter should the spray be then applied. On the other hand, if the spray is withheld for fear of defoliation scales will multiply to an extent sufficient to jeopardize the trees, and certainly result in a dirty crop. General orchard experience is decidedly in favour of a thorough autumn oil spraying as late as possible—that is, before the sap ceases to flow freely.

The land should be worked rather towards the trees, leaving a depression, if not a furrow, between the rows, with the line of fall to provide a get-away for surplus winter rains. This work is particularly necessary where cover-crops are to be grown during winter, as they can be left undisturbed without fear of the trees becoming waterlogged later. Lupins, or any other desired green crop, may be sown after a good rainfall. Sowing with the first autumn rains usually results in a good stand.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

FEEDING AND MANAGEMENT OF THE PULLETS.

FEEDING and handling of the stock at the present time require considerable judgment on the part of the poultry-keeper.

The majority of the pullets will be exhibiting signs of coming to a laying-point, such as making a cackling noise, showing a red and more or less developed comb, a fullness in the abdominal region, and generally an adult shape. A common mistake, especially at this period of the year, is to provide a similar ration for all birds in the flock. The adult birds which it is not intended to breed from should be given different treatment from the pullets. In the former case a forcing diet should be provided, in order that every available egg may be secured before the moulting process takes place, and at a time when

eggs rule at a high level of value. On the other hand, the pullets should be given an ample but plain ration. This is in order to guard against the common weakness of forcing birds to maturity before they have attained proper development.

The greatest drawback of prematurity is that the bird seldom grows to a desired size or lays a good marketable egg, and consequently never makes a desirable breeder. The question of an export trade must always be kept steadily in view, and it is not the too early maturing bird that must be depended upon to produce the desired weight of egg demanded for this trade. Experience goes to prove that if we are to build up a sound oversea trade no egg under 2 oz. in weight should be shipped.

Reverting to the feeding and management of the pullets, it must not be inferred that the laying-period should be delayed by supplying a scant ration or one of inferior quality. The feeding of the pullets when nearing the laying-point cannot be too liberal, but it should be plain, consisting chiefly of good sound grain material and as much green stuff as they will eat. Where the danger lies is including in the ration too much rich food, such as milk, meat, or its substitutes. These foods tend to stimulate the reproductive organs before proper development has been attained. In a general way pullets should not be encouraged to lay before they reach an age of six months at the least. Even at this stage any forcing diet should be sparingly supplied, and increased by degrees as the birds develop.

ESSENTIAL ECONOMIES.

In these days of dear foodstuffs it is of the first importance that every ounce of food be utilized to the best advantage, for the purpose of reducing the cost of production. If broody hens, for instance, are allowed to sit on the nests for days at a time it will mean a continual drain on the profits of the poultry-keeper. This not only means a loss in eggs, but the breeding of insect pests is encouraged. Broody hens should be removed from the nest and placed in a broody-coop immediately they show the first desire to sit. It should be remembered that the longer the bird is allowed to sit on the nest the longer will it take to lose the broody fever, while, in addition, its failure to leave the nest to regularly take food and water will have the effect of lowering its vigour, which will consequently retard egg-production for a considerable period. Further, allowing a bird to remain on the nest for a long period is practically inviting an early moult. Many a good bird has been culled from the flock as an early moulter and a poor layer simply because it has been improperly handled during a broody period. The foolish practice of starving broody hens should be avoided; on the contrary, they should be given as much nourishing food as they will eat, in order that egg-laying may be resumed in the shortest time possible.

The day has gone by when it was considered that hens were all the better for a rest. Of course, birds which are being kept for laying purposes only are now referred to. I quite agree that birds which have been recently selected for next season's breeding-pens should be discouraged from laying to their extreme capacity. Such birds should have a good rest, to give them an opportunity of building up their vitality before being called upon to lay eggs for the renewal of stock.

In addition, where possible to do so, they should be specially marked, and placed on a good range by themselves. Then, by providing a more or less spare diet, or a frequent change of diet, and change of quarters, they will be discouraged from laying. In addition, such treatment, combined with the special exercising-space available, will tend to prevent them from becoming overfat at mating-time—a condition which is often responsible for the production of infertile eggs, poor hatches, and chickens that are difficult to rear.

Another expensive present-day leak is the food consumed by sparrows. The loss from this cause is considerable in normal times, but with the present high cost of food it must be a serious drain on the profits of those poultry-keepers who fail to guard against the nuisance. The only safe course to prevent this waste is to feed the poultry in the house at all times, care being taken that the open part of the front is covered with bird-proof wire netting. I have in mind several plants, both large and small, where the modern lean-to partly open-front house is adopted, in which the fowls are fed at all times, and yet sparrows take a heavy toll of food. This is because of the mistake made of using 2 in. mesh netting. Obviously this is false economy, as the food consumed by the small birds in probably a few weeks would cost more than removing the cause by replacing the large-mesh netting with a bird-proof size.

Especially will money be lost by holding on to old hens which have passed their best period of production. Obviously such stock must mean a constant drain on profits made by the younger birds. The same applies to keeping cockerels beyond the correct marketable age. If a cockerel is to show a profit over its keep it must be well fed from first to last, and marketed when from four and a half to five months old.

A form of false economy, especially when poultry-food is dear, is to underfeed the laying flock. It should be remembered that eggs are chiefly manufactured from the food eaten, and it is impossible for a hen to lay a 2 oz. egg day after day, and at the same time maintain her bodily health, if not supplied with an abundance of good nourishing food. Foodstuffs are certainly high in price, but so are eggs; and where only well-selected stock are kept they will yield a good profit over cost of production, provided, of course, that good management goes hand-in-hand with good feeding. The fact that food is dear does not imply that it should be given in less quantity, or that a poor-quality food should be supplied, but rather that all inferior stock should be culled out; while at the same time every endeavour should be made to use substitutes for dear grain, such as green food—preferably lucerne, clover, &c.—which can be grown and supplied in ample quantities.

In the past it has been possible for the poultry-keeper to make a profit while neglecting many important details of the business. If these weaknesses are now corrected the money thus saved will go a long way towards counterbalancing the increased cost of production caused by high-priced foodstuffs. In poultry-keeping it is the little things properly attended to which make all the difference between profit and loss. Very often the management may be correct to a great degree, but by not realizing what attention to small details really means the profits are consequently reduced.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

SHELTER.

As in the spring, a vital necessity at this time of the year is shelter for the hives. Brood-rearing must be encouraged if the bees are to go into winter quarters sufficiently strong to give good results the following season. If a shelter hedge or fence has not been provided, an excellent temporary breakwind of manuka scrub can be erected. Shelter without too much shade is the life of an apiary, and on no account should large trees be utilized as a means for protecting the hives. The spaces between the trunks are productive of draughts, and the high branches exclude too much of the sunlight. A line hedge, 8 ft. to 10 ft. high, is the ideal shelter for an apiary.

FOUL-BROOD.

The risk attendant on carrying over diseased bees is too great, as the trouble is more likely to be spread in the autumn and spring by robbing. In cases where weather conditions have prevented successful treatment, or in which foul-brood disease is detected on making a final examination prior to putting the bees into winter quarters, it is advisable to remove all combs showing the slightest signs of the disease. Where the disease is detected in a bad form nothing will be gained by holding the colony over for treatment, and it is much the safer plan to destroy it. In mild cases remove all the diseased combs and substitute clean drawn-out extracting-combs; provided plenty of capped stores are given, this will tide the colonies over until the spring, Mark all infected colonies as a reminder for early treatment. Avoid disturbing diseased hives in the off season, and guard against manipulations calculated to disturb the bees and induce robbing.

ROBBING.

Where the extracting has been completed in good time and every care taken to remove temptation from the bees' path there should be little or no danger from robbing. However, where the honey has been left in the hives till late in the season the act of opening the hives and removing the full combs is apt to arouse the bees' predatory instinct. On no account leave combs exposed one moment longer than necessary, either before or after extracting; carefully wipe any honey which may be spilled on wheelbarrow or any utensil in use at extracting-time, and see that every means of ingress into the disturbed hives is closed as soon as all manipulations are completed. Be sure the roofs are put on securely and that no robbers can crawl under them.

If robbing takes place in spite of all precautions, the apiarist should realize that he must take means to eradicate the trouble at once if he does not wish it to spread right through the apiary. He must realize that autumn robbing is very serious, and may tend to materially deplete his stocks before the bees settle down for the winter. The veriest tyro, by a little study of the entrance of a hive, can soon decide whether the colony is being robbed or not. Sometimes the young bees in their play-spell during the warm hours of

midday resemble, at a casual glance, a robber horde, but on closer examination the beekeeper will see that in such a case there is no struggle and consequent slaughter taking place at the hive entrance. Moreover, there will be a steady stream of workers in and out of the hive, intent on gathering the last of the failing honey-flow. Perhaps the surest indication of the well-being of a colony is the stream of pollen-bearers which every hive should have while the flowers last. If the apiarist sees the bees carrying in pollen without interruption he may conclude, whatever the excitement at the entrance, that the colony is not the victim of a hostile attack.

When robbing takes place in earnest perhaps the first indication the apiarist gets is in the noise the bees make. No other sound in an apiary is like it. It gradually develops into a steady purposeful roar, loud and aggressive, and in a short time the unfortunate colony will be assailed by a cloud of bees flying steadily at the hive, fighting with the inmates and with each other, and strewing the ground with the dead and dying. The beekeeper should at once contract the entrance of the hive until only two bees can escape at once. He should then pile wet grass high over the alighting-board, completely covering the entrance, and the grass must be kept wet. The bees outside will not force their way through the wet grass, and by the time those inside escape they will be glad enough to get out and stay out.

If bees persistently hang round a hive it is well to examine it as quickly and thoroughly as possible. Bees seem to have some uncanny instinct which tells them when a hive is weak or queenless, and if they persistently hover round one particular colony it is usually a warning to a beekeeper that all is not well inside. On examination the colony will usually prove to warrant removal and uniting with one stronger and better able to guard itself. If a colony of this kind has to be opened, any frames which are removed must be kept covered with the carbolized cloths useful at extracting-time.

One other matter to which the beekeeper should give his attention when the bees are inclined to rob is the protection of his honey-house. The windows should be provided with bee-escapes, so that all intruders may easily be removed, but on no account must there be any holes through which they can re-enter. Bees robbing a hive are bad enough for any beekeeper, but bees robbing a honey-house are like all the wild animals in a menagerie let loose, and the beekeeper who once allows this state of things to happen will usually reap his reward in the shape of innumerable stings from his infuriated subjects.

—*E. A. Earp, Senior Apiarist.*

HORTICULTURE.

VEGETABLE-GROWING.

THE mild climate of New Zealand permits, with few exceptions, the sowing of crops during the greater part of the year. In a well-drained, sheltered spot onion seed-beds should now be sown (if not already done) for planting out in spring—that is, where autumn

sowing of the main crop is necessary. In any case a sowing of the large mild white Italian onions made now will be ready for harvesting in spring and early summer, when they are in great demand for salads.

Warm, sheltered slopes where the soil is good may be sown down in dwarf green peas for a first early crop.

Also seed-beds may be made and sown with main-crop cabbage, cauliflower, and cabbage lettuce, the intention being to allow these plants to stand over for planting out in early spring. For this purpose sow rather thinly. Cauliflower and cabbage for early spring cutting should now be planted out from seed-beds into a piece of good well-drained land.

Complete earthing up the celery crop. Cut down the asparagus growth level with the ground as soon as it ripens and before the seed falls.

Harvest potatoes, onions, pumpkins, &c., as they mature. Remember the keeping-qualities largely depend on how this is done. Pumpkins are best cut and allowed to remain for a while as they grew before gathering them. They should then be stored in a dry, airy place.

GREEN - MANURING.

Idle land is much inclined to become infested with bad weeds and sour conditions before a good natural herbage becomes established. Economical management demands that it should be taken in hand as soon as a crop is harvested.

The increase in the use of motor-vehicles does not appear to have much special connection with horticulture, but the truth is it is causing a fundamental change in practice. In the past the usual method at this season as soon as a crop was harvested was, under some circumstances, to plough in a heavy dressing of stable manure by way of preparing the land for the next crop, and with cheap supplies this was a quick and efficient method of reconditioning land. Unfortunately, that supply has now passed, and while chemical fertilizers to some extent supply the need, they do not afford the humus and fibre that were supplied to the land by stable manure. These valuable ingredients are now obtained by sowing the land to be treated with a green cover-crop, and, when mature, ploughing it in and allowing it to decay—a slow method which in the case of valuable land is a serious cost, as the time could otherwise be devoted to growing a marketable crop. For this reason many growers are inclined to starve the land for want of these supplies.

Experience will doubtless improve our methods in this direction, but meanwhile it is necessary to see that each area has reasonable attention of this kind periodically. By selecting cover-crops of a hardy nature they may be grown during the winter, when the land can best be spared from growing crops that are directly marketable. At this season, as soon as a market crop is harvested, disk or harrow down the land and sow a hardy green crop. The fertilizers in the ground will soon assist it to make a strong growth, which will keep the land clean, and mature in time to be turned in and decay before the spring planting. With the proper use of lime dressings this method can be relied upon to greatly assist in keeping the soil in good order.

TOMATO GLASSHOUSES.

Tomato glasshouses will yield a good crop all the easier next season if they are well cleaned up now as required. Where insect or fungus troubles have been epidemic during the season, or have shown a tendency to become so, the present time affords the best opportunity of dealing with it. In such cases clean up the house and land well, and sow down the latter with a suitable green cover-crop, leaving ample ventilation on.

SMALL-FRUITS.

The preparation of land intended for a strawberry crop should now be completed, and delivery obtained of the plants as soon as they are available. When they arrive, open up the bundles and air them. Trim up the roots and tops, and set out the plants as soon as the weather and the condition of the ground permit. This operation is facilitated if a fine, even, firm surface is first obtained. It is important to plant only varieties proved suitable to the locality, and to obtain the plants from a supplier with a reputation for careful selection. Experiments with new varieties are important, but they should first be tried on a small scale only.

Land to be planted out in bush fruits should now receive attention. Most of these plants have fibrous roots near the surface, which preclude deep cultivation after planting. For this reason deep and thorough preparation is necessary now. Place the order for plants without delay; supplies of this kind are usually short. Obtain delivery as soon as the plants are ready for lifting, and heel them in carefully; they will then be ready for planting out when required.

WALNUTS.

The season has been a good one for walnuts in most districts. This valuable crop is worth careful attention. Too often the local sample compares badly with the imported nuts, although their intrinsic value is appreciated by the consumer. With a little more attention in harvesting, the local nuts might obtain a decided preference on the market. Gather the nuts as soon as there is a fair picking on the ground, and thus avoid stained shells. It is of some assistance to shake the branches with a long boathook-like implement. Sweet, well-flavoured kernels are obtained by thorough curing. For this purpose the nuts may be spread on shallow trays and thoroughly dried, going through them occasionally and turning them over. Avoid drying them too quickly in a hot sun, or nuts that are poorly sealed will open. Afterwards shake them in wire riddles of a suitable size to dispose of small nuts and litter, and finally pick them over, removing broken and blighted nuts, also those with husks adhering. They have then only to be bagged up ready for marketing.

—*W. C. Hyde, Horticulturist.*

Dairy Farm Instructors.—The most recent appointment of an Instructor is to a group of three dairy companies in the Nelson District. In the Manawatu two butter- and two cheese-making companies have recently combined for the services of an Instructor, and several other companies are awaiting opportunity to join existing groups for the same purpose.

WEATHER RECORDS: FEBRUARY, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE month was remarkably cool, the temperature showing the lowest February mean for fourteen years. Two or three very cold nights were experienced, and some light frosts, which are most unusual, occurred in places widely apart.

The daily weather charts for the first half of the month disclosed the existence of three considerable areas of low pressure off the east coast of the South Island. These accounted for the strong southerly winds which prevailed, and resulted in heavy rains and cold weather, particularly in the South. The total rainfalls in Otago were from 100 to 200 per cent. above the average for the month in previous years, and the weather was altogether unseasonable, being the wettest February for thirty years. Rainfall was, however, from 50 to 60 per cent. below the mean about Nelson and Collingwood, in the north-western districts of the South Island. Rainfall was also from 40 to 60 per cent. below the average in most parts of the North Island; but Kawhia, Wanganui, and Foxton were exceptions, reporting falls above the mean.

The latter half of the month, though very changeable, was more equable, except for a "southerly buster" between the 27th and 28th. This brought welcome rain in Hawke's Bay, which, however, still suffers from the general dryness that has persisted there during the past six months.

—*D. C. Bates, Director.*

RAINFALL FOR FEBRUARY, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	0·50	6	0·16	2·95
Russell	2·48	4	1·04	4·35
Whangarei	0·74	6	0·28	4·95
Auckland	2·57	16	0·84	3·06
Hamilton	1·85	15	0·68	2·85
Kawhia	3·76	13	0·94	2·40
New Plymouth	3·46	13	0·62	4·01
Riversdale, Inglewood	4·52	14	1·22	5·30
Whangamomona	3·88	14	0·96	4·14
Tairua, Thames	0·96	8	0·50	4·52
Tauranga	1·01	7	0·36	3·58
Maraehako Station, Opotiki	1·84	8	0·64	3·70
Gisborne	2·17	10	0·60	3·63
Taupo	1·52	5	0·96	2·81
Napier	1·50	9	0·40	2·92
Maraekakaho Station, Hastings	1·24	9	0·32	2·52
Taihape	3·76	13	0·78	2·52
Masterton	4·06	12	0·79	2·70
Patea	1·94	11	0·54	2·33
Wanganui	4·39	11	1·05	2·49
Foxton	2·59	5	1·60	1·71
Wellington	2·63	9	0·83	3·20
South Island.				
Westport	5·35	18	1·58	4·37
Greymouth	6·84	16	1·20	6·13
Hokitika	10·12	17	2·14	7·20
Ross	10·84	15	2·68	8·45

RAINFALL FOR FEBRUARY, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Arthur's Pass	12.74	16	2·75	7·55
Okuru, Westland	15·52	15	2·84	7·92
Collingwood	2·22	15	0·54	5·63
Nelson	1·38	8	0·49	2·77
Spring Creek, Blenheim	2·63	8	0·95	2·30
Tophouse	3·89	13	1·30	4·50
Hanmer Springs	4·98	12	1·12	2·93
Highfield, Waiau	3·86	10	1·17	2·59
Gore Bay	3·60	12	1·57	3·50
Christchurch	2·79	12	1·44	1·77
Timaru	2·98	13	1·12	1·89
Lambrook Station, Fairlie	4·01	9	1·58	1·95
Benmore Station, Omarama	2·80	11	0·90	1·23
Oamaru	5·29	13	1·65	1·72
Queenstown	4·58	17	1·49	1·76
Clyde	2·34	12	0·88	0·99
Dunedin	6·98	21	1·17	2·69
Wendon	5·58	18	1·18	1·57
Gore	4·83	22	0·92	2·47
Invercargill	6·22	22	0·70	2·68

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 31st December, 1925, to 25th February, 1926, include the following of agricultural interest:—

No. 52651: Phosphate-rock-grinding process; A. A. Adams, Auckland. No. 52967: Sheep-bearing appliance; W. H. Taylor, Hastings. No. 53128: Flax bleaching and drying; S. H. Maddren, Christchurch. No. 53351: Milk and cream cooling; L. Hansen, Christchurch. No. 53552: Tractor-control; H. W. Johnson, Dunsandel. No. 54043: Sheep-shears; H. Norman, Pembroke. No. 54606: Milking-machine teat-cup-cleansing means: T. Shiels, Invercargill. No. 54926: Incubator and brooder; H. A. Dawber, Ouruhia. No. 55089: Tractor and plough hitch; P. M. Heffernan, Palmerston South. No. 52727: Cattle-choking prevention; R. K. Phelps, Tauranga. No. 53150: Concrete fencing-post; E. Andersen, Midhirst. No. 53322: Branding-device; W. C. Haynes and C. W. Pickles, Hastings. No. 53964: Fumigating apparatus for animal-destruction; W. F. Lange and T. H. Varcoe, Mount Gambier, S. Australia. No. 54776: Milking-machine; Clark and Fauset, Ltd., Brisbane. No. 54987: Flax-dressing method; F. T. F. Evans, Auckland. No. 55185: Milking-machine pulsator; A. W. Reid, Stratford. No. 55251: Harrow; H. S. Pearson, Springston. No. 55274: Concrete fencing-post; A. D. Brown, Eskdale. No. 55277: Milking-machine pulsator; R. B. Forsyth, Christchurch. No. 55373: Sugar-of-milk manufacture; J. Chism, Edendale. No. 55438: Tractor-wheel; W. J. Smith, Warracknabeal, Victoria. No. 53781: Shovel; W. Hooper, Cromwell. No. 55502: Milk-powder oxygen-content-reducing process; Merrell-Soule Co., Syracuse, U.S.A. No. 55506: Milk-can sterilization; C. E. Gray, Oakland, California. No. 52676: Milk and cream treatment; F. L. Armitage, Auckland. No. 53027: Flax-stripper feed-rollers; A. Thomson and C. E. Petersen, Bull's. No. 55566: Cow-udder sprayer; A. Smith, Tauranga.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price 1s.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

ANGORA GOATS.

"SUBSCRIBER," Tahora :—

Could you let me have the following information concerning Angora goats : Whether they compare favourably with dry crossbred sheep on rough country as a source of income ; whether there is a heavy death-rate or not ; what price the wool fetches, and how much they clip ; does a goat prefer herbaceous foods to grass ?

The Live-stock Division :—

Angora goats can never compare with sheep as a source of income. With ordinary care and attention to feed, the Angora goat is a healthy animal, and mortality from disease is low. Angoras clip from 2½ lb. to 3 lb. The quantity of mohair offered in New Zealand is small, but a market always exists. The ruling price on the local market is 9d. or 10d. per pound. This does not refer to first quality, however, for which a higher price is obtained. Although a goat consumes a quantity of rough herbage, it cannot be said that this animal does not like grass, and in successful goat-keeping a change on to good pasture occasionally is essential to maintain the animals in healthy condition. It is because of neglect of this point that goat-keeping has so often proved a failure.

BASIC SUPERPHOSPHATE.

H. FORSTER, Mercer :—

Will you kindly let me know if there is any standard for mixing basic super ? What percentage of lime should be added, and what kind—burnt or carbonate ?

The Fields Division :—

Basic superphosphate, as supplied by fertilizer-manufacturers, consists of a mixture of superphosphate and burnt lime ; 15 per cent. of burnt lime is added to the superphosphate, mixed thoroughly, and allowed to stand for twenty-four hours while heating takes place. Mixtures of superphosphate and ground limestone in varying proportions, as made by farmers, are often wrongly called basic superphosphate. They are in reality mixtures of carbonate of lime and super, the phosphate being rendered less soluble than in basic superphosphate.

HORSES WITH SORE SHOULDERS.

S. B., Waharoa :—

We are having a lot of trouble with two of our horses ; they are continually breaking out in sores on the wither underneath the flaps of the collar. Before we took them over they were worked with too small a collar. We got new collars for them, but their necks are no better. We have cut the hair off, and bathed the sores and dressed them with gall cure, and we tried vaseline and Safonia mixed together, but it seems to make no difference. Would you kindly advise as to the best treatment ?

The Live-stock Division :—

Sore shoulders in horses is usually the result of wearing a badly-fitting collar, or allowing the collar to get hard from the accumulation of sweat and dirt becoming dry upon it, also from not keeping the skin of the animal clean where the collar rests. A collar too small or too large will cause trouble, and also allowing horses, especially young animals, to work hard before they are used to it. Some horses, however, are very difficult to keep whole, and these require careful fitting of the collar, and attention. The condition of the animal has also an important bearing. A careful saddler will provide a well-fitting collar, and that must be kept clean. If the animal has been sweating, and it is necessary to stand for

some time, it is advisable to raise the collar and allow the air to get at the shoulders, and see that the mane is not under the collar. After work, bathe the shoulders with a solution of common salt and cold water—two tablespoonfuls to the gallon—and apply the following lotion to the sores: Zinc sulphate, 1 oz., and lead acetate, 1 oz.; put into an ordinary quart bottle, and fill with camphor water or cold water. Before applying, shake the bottle well, and label it "Poison." A saturated solution of alum and water is useful applied to the shoulders after removal of collar after work. If the shoulders are bad, one must allow the wounds to heal before using the collar again, or have the sores protected from friction by judicious padding if the animal is kept at work. If this can be done it has the advantage of preventing the shoulders from becoming soft and out of condition. Sometimes it is necessary to resort to the use of breast harness instead of a collar.

DESTRUCTION OF RAGWORT.

"RAGWORT," Horotiu:—

Kindly let me know if there is a definite thing to destroy ragwort. Could you suggest a chemical or an acid to apply to the roots? We have only about a dozen plants on the place, which are dug out every year, but in spite of what we do they repeatedly grow again next year.

The Live-stock Division (Noxious Weeds Inspection):—

Where only a few scattered plants exist—the nucleus of a countryside pollution—the best possible method of destruction is to pull or dig them up by the roots, and burn the pulled growths to prevent the resowing of the land by the seed, which will ripen if the plant is simply pulled and let lie. Possibly this may be partly the reason for the seasonal recrudescence you mention, for while the flowering growths that are removed are in their season of maturity those in the first stages of development that come to fruition in the following year are possibly overlooked. It therefore becomes essential that the action suggested, to be effective, be continued over the full periods of development and maturity. No chemical application is recommended if the procedure stated is adopted.

DANTHONIA GRASSLAND.

J.C., Aranga, Northern Wairoa:—

Will you kindly give me some information on danthonia-grass? I have got about 300 acres in danthonia (just bought the farm), and have no experience with this grass. The land here is light gum land; it dries up very easily. I have 200 acres still in fern, and should be glad to have your opinion about danthonia before I put this area in grass.

The Fields Division:—

Of the two danthonia species, *D. pilosa* and *D. semiannularis*, the former, on account of its close turf-forming properties and higher palatability, is the one generally advised for sowing on the poorer types of fern and manuka country, especially where the soil is light and tends to dry out in the summer. In such places *Danthonia pilosa* is the most valuable grass we have for giving the necessary cover to compete with the secondary growth, and has the advantage that it will stand fire, and can thus be used for carrying a fire through such growth. *Danthonia semiannularis*, which has longer leaves and generally gives a larger amount of this dry herbage in the summer, is more suitable for the purpose of cleaning up land by fire, but this advantage is outweighed by the better feeding and turf-forming properties of *Danthonia pilosa*.

With regard to burning off, as already stated, danthonia tends to run away to dry growth in the summer, and this growth, together with the young fern or manuka, can be burnt off. If the growth is fern, it should be burnt in the late autumn, about the end of March or April. Where manuka is coming back it is better to burn off in the early spring. This can be done only when very light stocking is done during the winter and the dry growth saved for the burn. A few seasons of burning off should suffice to kill the fern or manuka and form a pure danthonia pasture. Such a pasture tends to get away each year, and becomes unpalatable to sheep and indigestible to lambs. The usual practice is then to

burn this growth about February or March, when the danthonia comes away rapidly, providing succulent green feed. Such burning is wasteful of nitrogen. A better practice is to stock with cattle during the autumn and winter, following the cattle with sheep. The cattle can handle the dry stuff, and leave the pastures short and sweet for the sheep in the spring.

In the North paspalum is largely taking the place of danthonia, except on the higher and drier slopes where it cannot compete with danthonia. With regard to your 200 acres in fern, we would therefore advise you to sow with the danthonia 4 lb. to 6 lb. of paspalum per acre, after burning off the fern in the autumn. Both of these grasses are slow to establish, and it is necessary to add a mixture of temporary grasses and clover to the permanent portion. A suitable mixture for surface sowing per acre would be: Italian rye-grass, 3 lb.; perennial rye-grass, 6 lb.; red clover, 2 lb.; Danthonia pilosa, 6 lb.; paspalum, 4 lb.; brown-top, ½ lb.; Lotus hispidus, 1 lb.; Lotus major, ½ lb. Disking before sowing is a great advantage—in providing a seed-bed—and should be practised when possible.

After clearing an area of fern and manuka by burning off danthonia it is possible to raise the fertility by means of top-dressing and the surface sowing of clovers such as white clover, red clover, and Lotus major, so that cocksfoot, crested dogstail, and perennial rye will thrive and gradually take the place of the danthonia. On small areas it is more profitable to so raise the fertility by top-dressing than reduce it by continually burning off danthonia and paspalum for the sake of the succulent feed. Danthonia, paspalum, and brown-top must be relied upon to give the maximum growth on the poorer classes of soils where the better grasses do not thrive.

IMPORTATION OF GRAPES OR GRAPE-VINES.

THE regulations under the Orchard and Garden Diseases Act governing the importation of grapes or grape-vines into New Zealand have been amended as from 4th March.

Clause 3 of the principal regulations is revoked, and the following substituted: Grapes may be introduced into New Zealand from Australia, or from the Dominion of Canada or the United States of America, provided that every shipment of grapes must be accompanied by a certificate as set out in Form No. 1 of the Third Schedule hereto, signed by the shipper, setting forth the number and kind of packages, the shipping-marks, the name of the grower of such grapes, the locality of the vineyard, and the State or province where such grapes were grown, and certifying that no downy mildew or phylloxera is known to exist within five miles of the vineyard where such grapes were grown, that no grape-vine foliage or wood is attached to such grapes, that no grapes from any other vineyard than the one specified as aforesaid have been mixed with the consignment, and that such grapes are contained in clean, new packages not previously used for any purpose; also by a certificate, as set out in Form No. 2 of the Third Schedule hereto, signed by an officer of the Department of Agriculture in the State or province where such grapes were grown, certifying that such grapes are clean and free from disease, that no downy mildew or phylloxera is known to exist within five miles of the vineyard where such grapes are certified by the shipper to have been grown, and that no grape-vine foliage or wood is attached to such grapes.

Clause 7 is similarly revoked, and the following substituted: The introduction into New Zealand of grape-vines or portions thereof, except grapes, is prohibited, save that the Director of the Horticulture Division, Department of Agriculture, may, with the prior consent of the Minister of Agriculture, import grape-vines or portions thereof of special varieties.

The amended regulations, including the Third Schedule referred to above, are published in full in the *New Zealand Gazette* of 4th March, 1926.

New Rabbit-proof Fencing District.—The constituting of the Motunau Rabbit-proof Fencing District, North Canterbury, for the purposes of Part IV of the Rabbit Nuisance Act, is published in the *Gazette* of 25th February; also consequential alterations in the boundaries of the Hurunui Rabbit District.

THE REGINALD MACKINNON PRIZE.

THE late Reginald Mackinnon, a resident of Southland and formerly a runholder, bequeathed his property to be held in trust and used in perpetuity for public purposes, one-fourth of the income being for the encouragement of agriculture in Southland in particular and New Zealand in general, the latter by means of a prize for essays on agriculture written in New Zealand. Regulations have been recently issued by the trustees providing for and governing an annual prize for an essay on some subject bearing on the agriculture of New Zealand.

The scheme will also include a bursary of £30 to be held by a Southland pupil who intends to study agriculture in one of the New Zealand colleges. Other portions of the available income will be allotted to agricultural and similar associations in Southland as prizes for shows. In all about £400 a year will be applied to the foregoing purposes.

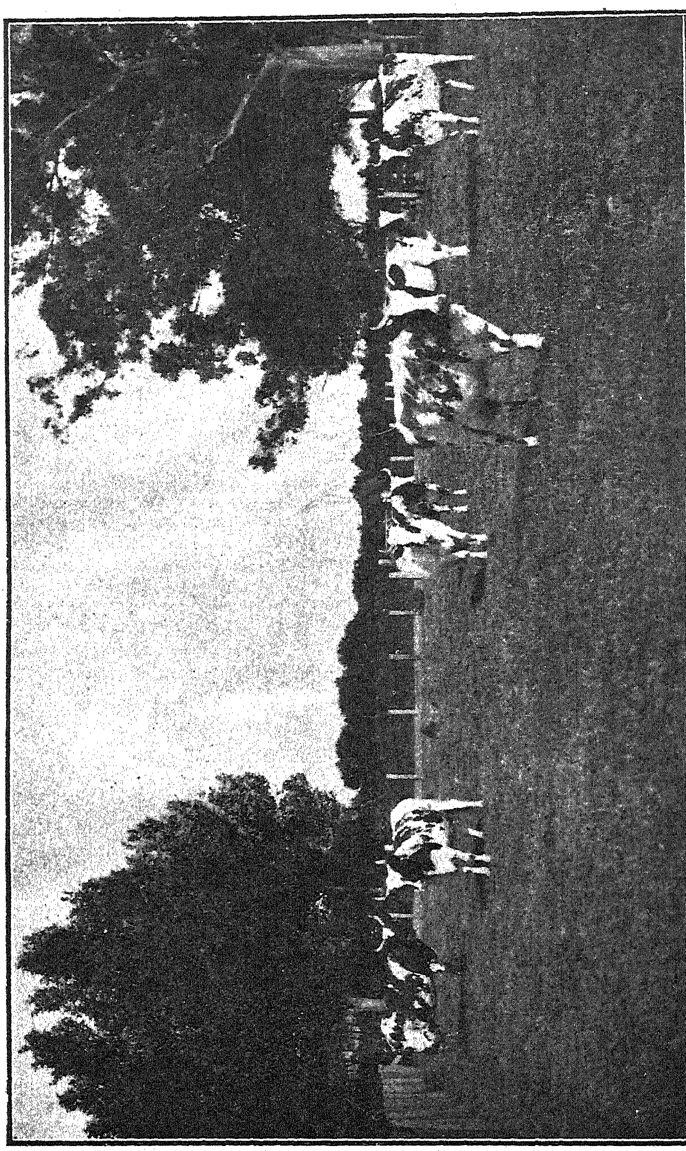
The prize for the above-mentioned essay will be awarded under the following conditions :—

(1.) The prize shall be known as the Reginald MacKinnon Prize. (2.) The object of the prize is to stimulate the search for, and distribution of, knowledge calculated to improve the practice of agriculture in New Zealand. (3.) The prize will be awarded for excellence in an essay, which, together with a precis of its contents, shall be forwarded to the trustees before 1st September in each year. (4.) The essays will be handed to two or more judges, who will be asked to determine if any of the essays is worthy of the prize, and, if so, which one. (5.) The writer of any essay entered for competition must have been a resident of New Zealand for the three years immediately preceding that in which he presents his essay. (6.) If the essay recommended for the prize has not been published before being entered for the competition it shall be published by the successful competitor before the prize is presented. (7.) No material part of the essay shall have been published for more than a year before it is entered for competition. (8.) Essays written as theses for university degrees, or as reports on investigations undertaken for remuneration, are not debarred from competing for the prize, but the judges will give less weight to such essays than to others of comparable merit. (9.) Only one prize (if any) shall be awarded in one year, but the judges may recommend that various consolatory sums be paid to unsuccessful candidates. Whether a prize be awarded or not in any year, the consolatory sums shall not total more than one-fourth of the funds available for the purposes concerned in these regulations for that year. (10.) The award of the judges shall be final and cannot be appealed against. (11.) The sum available for the prize will be expended by the trustees in part on a medal, or some other permanent record for presentation to the winner, and £50 in a cash payment. (12.) The sum available for the prize and any consolatory sums, as mentioned in clause 9, will be about £60 per annum. (13.) Whenever convenient, the trustees will arrange for the prize to be presented in some public manner.

The judges for the year 1926 will be the Director of Canterbury Agricultural College, Lincoln, and the Professor of Agriculture at Victoria College, Wellington. Essays should be sent by registered post, addressed "Trustees, Reginald MacKinnon Trust, 39 Esk Street, Invercargill." The trustees are Messrs. J. L. McG. Watson and C. Gilbertson.

IMPORTATION OF FERTILIZERS: DECEMBER QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 31st December, 1925:—*Sulphate of Ammonia:* From United Kingdom, 35 tons; Australia, 39 tons. *Nitrate of Soda:* United Kingdom, 1 ton; Chile, 760 tons. *Basic Slag:* United Kingdom, 564 tons; Belgium, 85 tons. *Bonedust:* Australia, 10 tons. *Phosphates:* Nauru Island, 7,031 tons; Ocean Island, 12,114 tons; New Caledonia, 4,988 tons. *Kainit:* United Kingdom, 30 tons; Belgium, 24 tons; France, 116 tons; Germany, 485 tons. *Muriate of Potash:* Germany, 5 tons. *Sulphate of Potash:* United Kingdom, 51 tons; France, 101 tons; Germany, 67 tons. *Potash, other:* United Kingdom, 95 tons; France, 326 tons; Germany, 365 tons. *Sulphate of Iron:* United Kingdom, 2 tons; Australia, 21 tons.



SOME OF THE AYRSHIRE HERD AT RUAKURA FARM OF INSTRUCTION.

The New Zealand

Journal of Agriculture.

VOL. XXXII. WELLINGTON, 20th APRIL, 1926. No. 4.

CITRUS-CULTURE.

VARIETY AND ROOT-STOCK EXPERIMEMTS AT TAURANGA.

FRESH citrus-fruits imported into New Zealand during the year 1924 were valued at £107,296 at the port of origin—not including the importation of such by-products as lime-juice and lemon-squash, jams, syrups, and peel. Under such circumstances the movement to establish commercial citrus-groves in the Dominion can be understood, seeing that it has been demonstrated many times and in a number of places that these fruits can be grown here, and that in some instances the local product is equal in quality to the best of the imported goods.

Definite progress in the establishment of commercial plantations, however, has been hindered by the lack of knowledge of the most suitable commercial varieties, and stocks on which to graft them, for the different districts. The kinds and varieties of citrus and stocks suitable for each are subject to the same unaccountable vagaries as other plants. Varieties and stocks commercially satisfactory in one district are not so good in another. At Tauranga it has been amply demonstrated that the climate and much of the land are eminently suitable for the commercial production of citrus-fruits. On the Horticultural Station of the Department of Agriculture there some seven years ago plantings were made of different varieties of lemons, limes, oranges, and grape-fruit; some of them on three or four different kinds of stocks. The results are being watched with interest, and it is anticipated that conclusions will be demonstrated that will be of great value to the citrus industry in that locality, and useful in some degree to other districts.

When the Tauranga Horticultural Station was disposed of in 1923 the Manager, Mr. J. H. Davidson, took over the homestead block and undertook the completion of the citrus experiments already under way. The following is a progress report recently made by him to the Department :—

No. 1 area, with which this report deals, consists of approximately 7 acres, comprising 493 lemon-trees and 145 trees of various sweet

oranges, grapefruit, and limes. The area was planted in August, 1918, with the exception of the stock-testing block, two rows of Genoa lemons, and about half of the sweet oranges, which were completed in the following spring.

Taking into consideration the poor condition of the block of land previous to it being planted in citrus-trees, and looking over it now, it must be admitted that the trees have done remarkably well. With the exception of the Lisbon lemon block, they have settled down to bearing.

LEMON AND ORANGE VARIETY TESTS.

LEMONS.

Eureka.—This variety has probably outstripped the others in growth and productiveness. While it is generally admitted in the Tauranga district that this variety gets away more quickly during the first few years than the other sorts and also comes into fruiting sooner, it has had the advantage over the others here in being situated next to the shelter hedge protecting the area from the prevailing south-westerly winds. The trees are worked on the common or rough lemon seedling root-stocks (*Citronella*). Picking commenced in 1922, and the average crop for the season ended 31st March, 1925, was two and a half cases of green fruit per tree, taking 150 fruits per case.

Lisbon.—This block of trees is the poorest in the area. They were a nasty lot when they came from the nursery, the root-stocks being old and stunted. The following season after planting the poorest of them were lifted and destroyed. In spite of the fact that they receive the same manurial treatment as the other sorts they do not respond as they ought to. Many of the trees have not yet borne any fruit, and the average picking for the block last season was approximately one quarter-case of fruit per tree.

Villa Franca.—The block marked "Messina" on the plan should now be included under this variety, as, with the exception of a few trees planted to replace stunted ones removed, they are all of the Villa Franca variety. The trees in the stock-testing block are the true Messina variety, and are dealt with under that heading. Villa Franca is undoubtedly a very promising variety for Tauranga conditions. It has the same advantage as the Eureka variety, of being a vigorous grower and an early bearer. The general habit of the tree is stocky and rigid. The branches are much shorter-jointed and less drooping than those of the Eureka, and the tree is therefore better suited for exposed situations. The fruit produced on young trees is decidedly of poor quality. The nipple does not grow out, which makes the fruit too round and rough looking. This condition has prevailed here more or less until this season, when the fruit is now mostly of first-class quality. It is also a heavier summer-bearing variety than the Eureka or Lisbon, and this is decidedly in its favour. Villa Franca promises to be one of the best for commercial planting in the district. Although more will be known of its general characteristics two years hence, I have every confidence in recommending it for planting at the present time. The average crop picked last season was two cases of fruit per tree.

LEMON ROOT-STOCK TESTS AT TAURANGA.

FIG. 1. EUREKA LEMON ON SWEET-ORANGE SEEDLING STOCK.

FIG. 2. EUREKA ON LEMON SEEDLING STOCK.

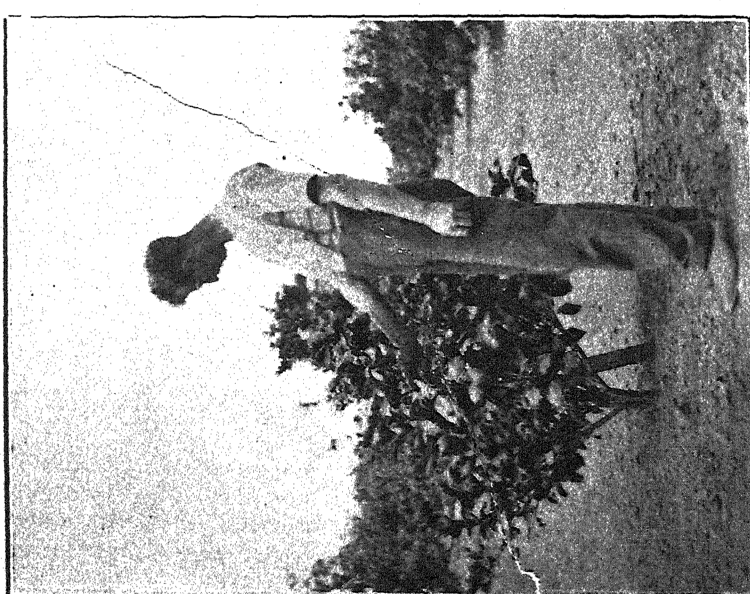


FIG. 3. EUREKA ON CITRUS TRIFOLIATA SEEDLING.

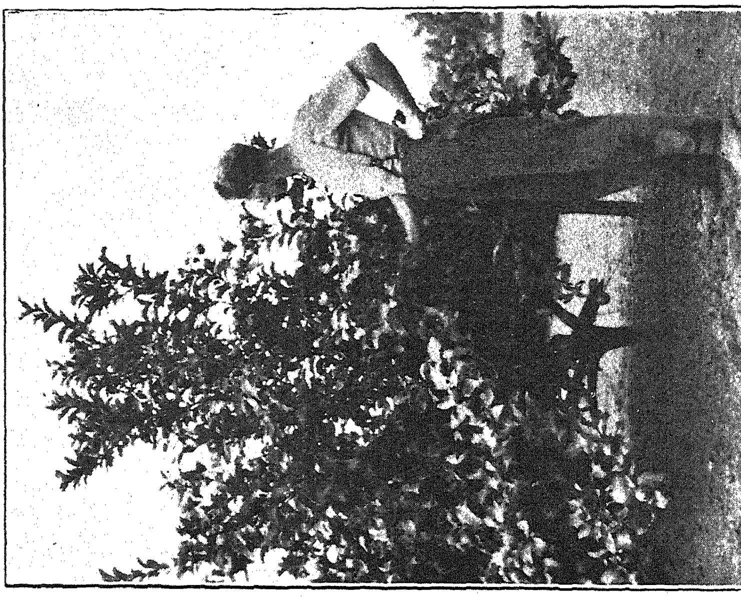


FIG. 4. EUREKA ON RANGPUR LIME SEEDLING.

Messina.—The few trees growing here are poor in comparison with the other varieties. The general habit of the trees is to form tall and upright growths, which are very thorny. Hard pruning is now being tried in order to induce the trees to spread. The first fruits borne were quite elongated. The quality was fair, but their shape made them unsuitable for commercial purposes otherwise than for the factory for making squash. However, the fruit picked this season has decidedly improved. The trees have borne little fruit as yet, and there is little to recommend it.

Genoa.—One row of trees was planted in August, 1918. As soon as growth was made and buds procurable, stocks were worked in the nursery and planted out in September, 1920. Genoa is practically unknown in New Zealand, and it will be difficult to say with any degree of certainty whether we have the true variety or not. It is, however, distinct from all the other varieties. It has the drooping habit of the Eureka, but with finer foliage and growth, and the fruit and fruiting-qualities somewhat resemble those of Villa Franca. Genoa is a heavy summer cropper. The original row of trees are worked on rough lemon root-stocks, and have grown equally well as Eureka and Villa Franca. The average crop picked last season was two and a quarter cases of green fruit per tree. The other two rows of Genoa are worked on Island sweet-orange seedling stocks. They are not growing so vigorously as those on the rough lemon, and this is probably wholly due to their heavy-cropping qualities. The trees commenced to bear fruit two years after planting, and at the same time as the original row from which they were worked. The fruit is of first-class quality, and the average crop for these small trees last season was one case per tree. Genoa is little known in citrus-growing countries, rendering it difficult to get a proper description of the tree, and whether those here are true or not is problematic. I can, however, recommend the variety for Tauranga conditions, and, as the trees settle down to heavy bearing, I anticipate it will be the best variety here.

Persian (sweet) and Rangpur (acid) Limes.—These are very vigorous growers, but the fruit is of no commercial value whatever.

ORANGES.

Best's Seedless.—This is a very disappointing variety on account of the long time it takes to come into fruiting. It has too much of the wild-seedling type about it, but this could probably be modified by selecting buds only from fruiting trees. There is one tree here worked on the lime, and which bore five fruits the third season from budding.

Ruby (Blood).—These trees are worked on sweet stocks, and are just commencing to bear fruit.

Washington Navel.—Trees on sweet-orange stocks are now in bearing, and are making fair growth. Those worked on the lime are dwarfs. This stock appears to be quite unsuitable for the Washington Navel.

Navelencia.—All the trees are worked on sweet stocks, and are growing vigorously and bearing fruit. It is a more robust grower

FIG. 5. LISBON LEMON ON SWEET-ORANGE SEEDLING STOCK.

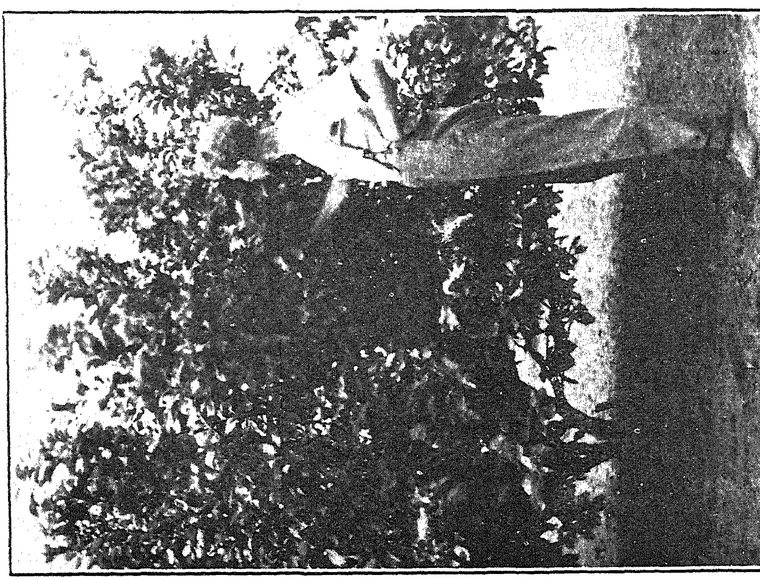


FIG. 6. LISBON ON LEMON SEEDLING STOCK.

FIG. 8. LISBON ON RANGPUR LIME SEEDLING.

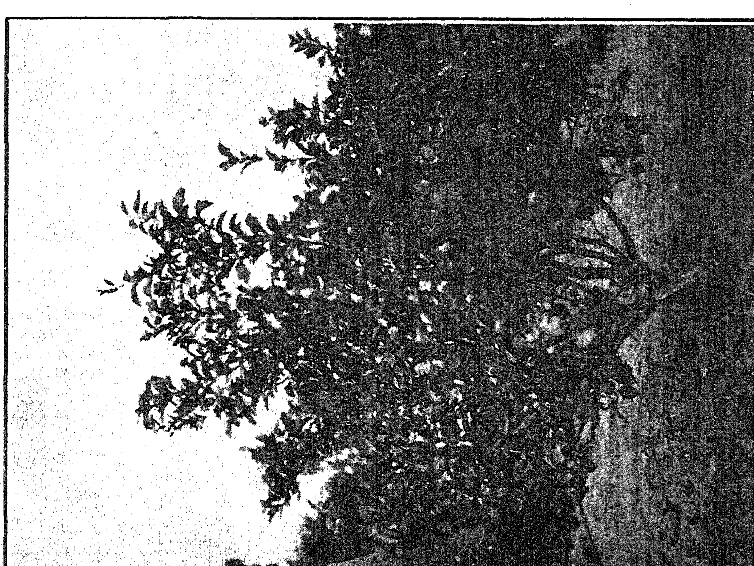


FIG. 7. LISBON ON CITRUS TRIFOLIATA SEEDLING.

than the Washington Navel. The fruit is more attractive in appearance, and is also of better quality. It also has the advantage of hanging on the tree six or eight weeks longer than the Washington. In fact, Washington should be picked before they are properly coloured, as they soon become dry if left on the trees after they are ripe.

Thompson's Improved Navel.—The trees are worked on both sweet-orange and lime root-stocks, and are doing equally well on both of them. The fruit is somewhat ribbed, which rather detracts from its appearance, but the quality is probably the best of all, while the fruit hangs on the trees as long as the Navelencia, and does not become dry like the Washington.

St. Michael.—The trees are worked on sweet-orange and lime stocks, and are growing and fruiting about evenly. Fruit is small, and ripens too early to be of much commercial value.

Joppa and Jaffa.- These are worked on sweet-orange stocks, and are growing well. They are rather shy bearers so far, and the fruit is only second-rate in quality. Both sorts are thick-skinned.

Poorman.—The trees are worked on lime and sweet-orange stocks, and are growing and bearing about evenly, although those on the lime stock commenced to bear a year earlier.

Grapefruit.—These are growing and bearing well, but the fruit is of little commercial value on account of the skin being too thick.

LEMON ROOT-STOCK TESTS.

Four trees at the end of each row of lemons are worked on various root-stocks. The crops indicated in the following notes are the average of the four trees on each kind of stock, the count being based at the rate of 150 lemons per case for the season ended March, 1925.

(1.) Eureka on sweet-orange seedling (Fig. 1): Trees are making good growth. Stock well suited for this variety. Yield, $1\frac{3}{4}$ cases fruit per tree.

(2.) Eureka on lemon seedling (Fig. 2): Trees similar in growth and appearance to No. 1. Growth probably a little finer. Crop, 1 case fruit per tree.

(3.) Eureka on *Citrus trifoliata* seedling (Fig. 3): A useless stock for Tauranga soil-conditions—too slow and dwarfing. Crop, $\frac{3}{4}$ case per tree.

(4.) Eureka on Rangpur lime seedling (Fig. 4): Trees have been badly blown, and growth somewhat retarded. Came into bearing early, and the fruit is usually of high quality. Though the trees are dwarfer than No. 1 and No. 2 they carry good crops, the average being $1\frac{1}{2}$ cases per tree.

(5.) Lisbon on sweet orange (Fig. 5): The most vigorous trees in the whole area, and in consequence the crop is light for the size of the trees. This condition, however, will quickly change as growth slows down. Crop, $1\frac{2}{3}$ cases per tree.

(6.) Lisbon on lemon (Fig. 6): Vigorous-growing trees, though not up to the standard of No. 5. Crop, 1 case per tree.

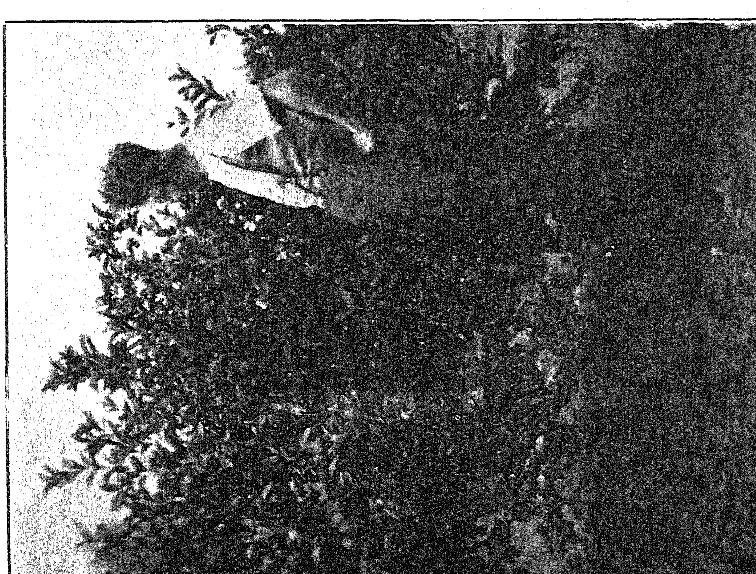


FIG. 9. VILLA FRANCA LEMON ON LEMON SEEDLING STOCK.

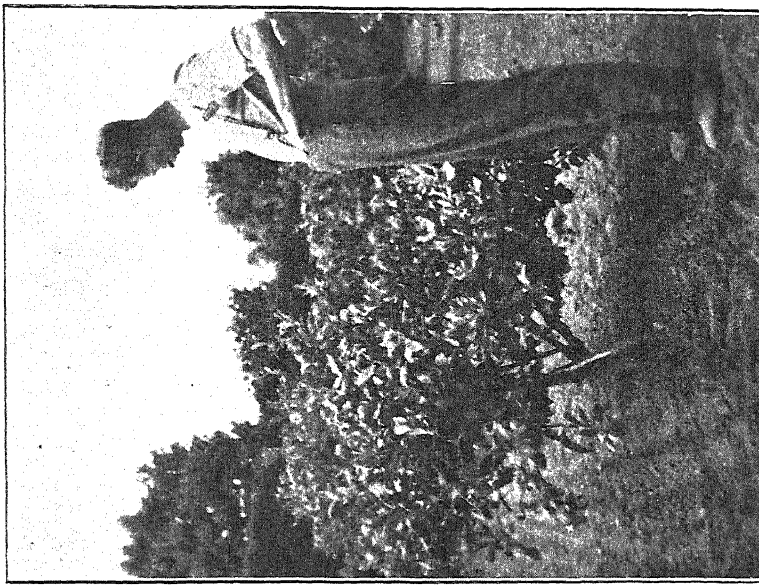


FIG. 10. VILLA FRANCA ON CITRUS TRIFOLIATA SEEDLING.

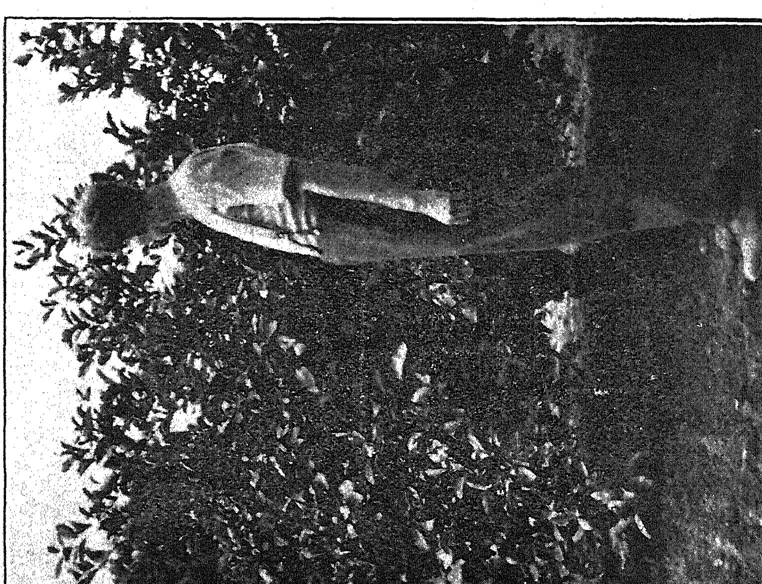


FIG. 11. VILLA FRANCA ON RANGPUR LIME.

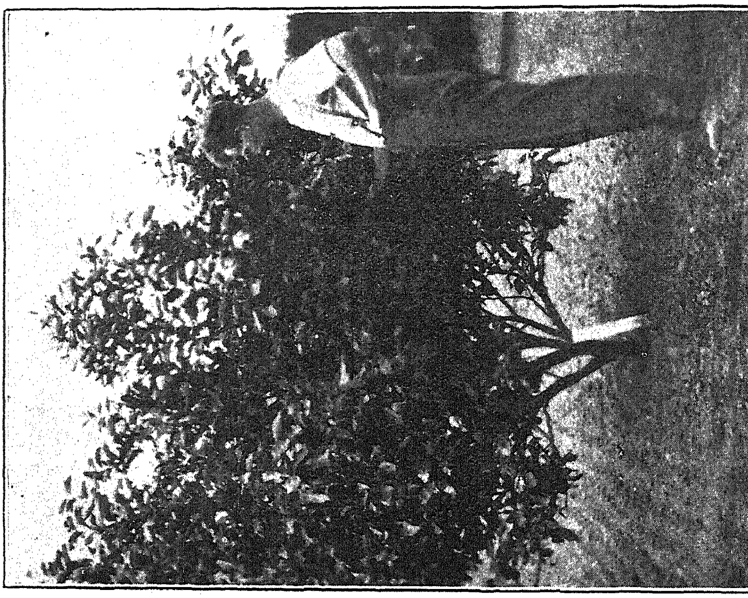


FIG. 12. MESSINA LEMON ON LEMON SEEDLING STOCK.

FIG. 13. MESSINA ON CITRUS TRIFOLIATA.

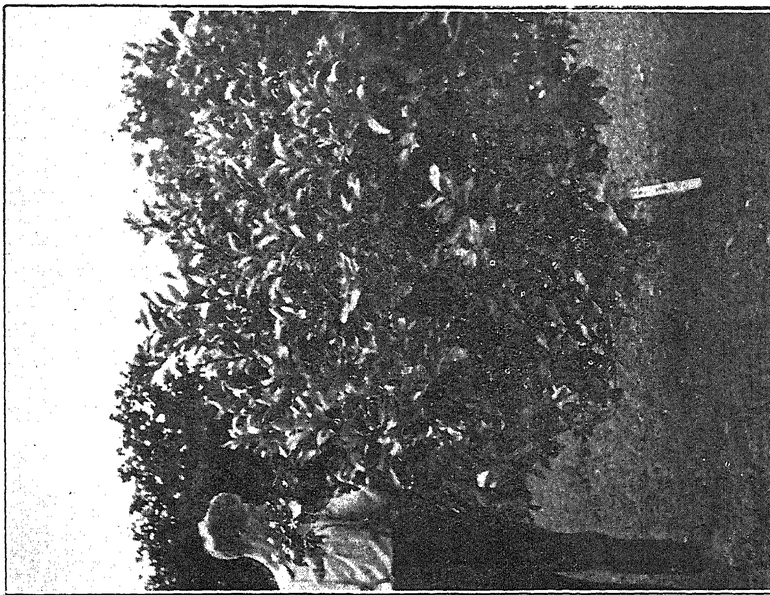


FIG. 14. MESSINA ON RANGPUR LIME.

(7.) Lisbon on *C. trifoliata* (Fig. 7): Trees doing much better than No. 3, and are bearing well. It is, however, too dwarfing. Crop, 2 cases per tree.

(8.) Lisbon on Rangpur lime (Fig. 8): One whole row is planted on this root-stock. Trees are vigorous and healthy. Six trees continue to bear rough fruit, and if no improvement shows they will be reworked. Several of the trees were severely blown about; two of them were entirely blown out of the ground, the root-system being so damaged that they had to be removed. The rooting-system of the lime is not

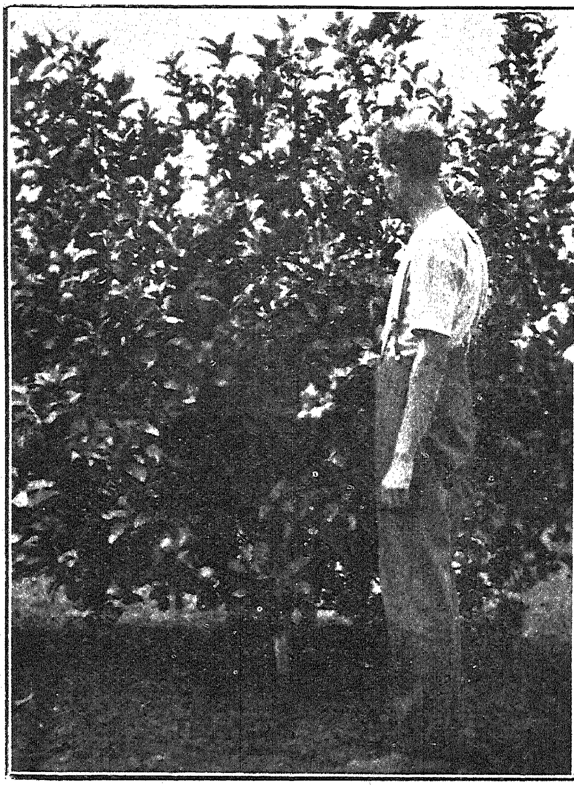


FIG. 15. GENOA LEMON ON LEMON SEEDLING STOCK.

so deep as that of the lemon or orange, which is rather a disadvantage. Lisbon is more vigorous on this stock than Eureka. Crop, 1½ cases per tree.

(9.) Villa Franca on lemon (Fig. 9): Trees are not so vigorous as they ought to be, but will probably make good ones yet. Crop, ½ case per tree.

(10.) Villa Franca on *C. trifoliata* (Fig. 10): A poor lot. Crop, ⅔ case per tree.

(11.) Villa Franca on lime (Fig. 11): Very promising; growth not too vigorous; well clothed with fruiting-wood. Crop, 1½ cases per tree.

(12.) Messina on lemon (Fig. 12): Average trees, and growing well. Doubtful if variety is suited to our conditions. Crop, $\frac{1}{3}$ case per tree.

(13.) Messina on *C. trifoliata* (Fig. 13): Of no value whatever. Crop, $\frac{1}{5}$ case.

(14.) Messina on lime (Fig. 14): Most promising trees of this variety, making nice growth and fruiting freely. Crop, $1\frac{2}{3}$ cases per tree.

FIG. 16. GENOA ON CITRUS TRIFOLIATA.

(15.) Genoa on lemon (Fig. 15): One row; a fine lot of trees, bearing well. Crop, $2\frac{1}{2}$ cases per tree.

(16.) Genoa on *C. trifoliata* (Fig. 16): Too dwarf. Crop, 1 case per tree.

(17.) Genoa on lime (Fig. 17): I consider these the best trees in the whole area. Their habit of growth and quality of fruit are almost perfection. The next two years should determine whether these ideal conditions are likely to be fixed or not. Crop, $1\frac{2}{3}$ cases per tree.

The accompanying photographs, taken last season by Mr. W. C. Hyde, the Department's Horticulturist, convey a good idea of how the different varieties are shaping on the various root-stocks in use.

CULTIVATION.

The area has been under clean cultivation until this season, when the method was altered a little and a growth of soft weeds allowed to grow for three months. The quality of the fruit was decidedly off last season, and I began to wonder whether we were not overcultivating. The quality is now greatly improved, but this season has been much drier than the last. This is a matter that requires careful investigation here over a period of years, and, of course, the method indicated should not be attempted in any orchard that is not free from couch-

FIG. 17. GENOA LEMON ON RANGPUR LIME STOCK.

grass. The plough is not used in this orchard at all. Cover-crops are disked in, and the Harvey one-way disk has been found to be all that is claimed for it. The tine harrows are preferred to the Planet Jr. cultivator, as they do not disturb the soil so deeply.

For maintenance requirements of the dairy cow about ¾ lb. of protein and 7 lb. of other digestible nutriments are necessary per day. Each pound of butterfat yielded requires 1 lb. of protein and 5 lb. of other nutrients. Hence, for maintenance, foods comparatively low in protein are efficient, but for milk-production highly nitrogenous foods are necessary.

STINKING-SMUT OF WHEAT.

IV. EXPERIMENTAL RESULTS FOR SEASON 1925-26.

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THE experimental results presented in the accompanying table confirm in general the results given by last season's work. Two methods of seed-treatment stand out as the best under present conditions in New Zealand. These are the formalin-steep and the copper-carbonate-dust treatments. Other materials such as Semesan, Uspulun, and Germisan, though offering interesting possibilities in the direction of seed stimulation combined with disease-control, are not yet procurable by farmers in this country. This objection also applies to copper carbonate, but arrangements are in hand to have both the material and machines available to treat a reasonable area of next season's seed wheat with this material.

SUMMARY OF RESULTS.

(For details of materials and methods see article II of this series, published in the *Journal* for May, 1925, Vol. 30, p. 302.)

Copper Carbonate.—The higher-grade copper-carbonate dust (No. 2), containing 54 per cent. copper, and used at 2 oz. per bushel, gave complete control of the smut, with, on the whole, a slight improvement in plants and heads over the untreated seed. The lower-grade product (No. 1), containing 26 per cent. copper, and used at 4 oz. per bushel, failed to completely control the smut and slightly damaged the seed.

Corona 640 and 640 S, Dupont 13 and 30, are new dust disinfectants from the United States not yet beyond the experimental stage. They all appear to be less effective in smut-control than copper carbonate, and would probably be much more expensive.

Semesan, used both as a dust at 1 oz. per bushel and as a steep at 0·2 per cent. for one hour, gave nearly complete control of the smut, with a slight increase of plants and heads as compared with the adjacent rows of untreated seed.

Uspulun and Germisan gave results not quite so good as those recorded last year. As the material was at least three years old it may have deteriorated.

Clarke's Wheat Protector gave complete control of the smut, but showed a good deal of injury to the seed.

Bluestone, used both at 1 per cent. (1 lb. to 10 gallons) and 2 per cent. (1 lb. to 5 gallons), gave complete control of the smut, with much damage to the seed.

Formalin, used at a strength of 1–320 (1 pint to 40 gallons) and at 1–480 (1 pint to 60 gallons), completely controlled the smut, but considerably lowered the vitality of the seed, especially that of the variety Velvet Chaff. It would be advisable in practice to use the 1 pint in 60 gallons rather than the 1 pint in 40 gallons strength now generally used. Presoaking the seed in water for six hours before treatment again greatly reduced the damage caused by the dip.

The samples of wheat used in the experiments, kindly supplied by Mr. C. H. Hewlett, manager of the Canterbury Seed Company,

Experiments on Stinking-smut of Wheat, Season 1925–26.

Velvet Chaff.

Treatment.	Percentage Germination. In Laboratory.	In Field. First Count. %	In Field. First Count. PE ±	In Field. Mature Plants.	Plants. Total.	Plants. Smutted.	Plants. Percentage smutted.	Heads. Total.	Heads. Smutted.	Heads. Percentage smutted.
Control ..	97.7	86.0	1.04	85.0	170	24	14.1	551	60	10.9
carbonate No. 1, 4 oz.	99.7	91.5	0.87	90.5	362	2	0.5	1,122	5	0.4
Control ..	97.7	90.0	1.20	90.0	180	30	16.6	584	74	12.7
carbonate No. 2, 2 oz.	99.2	92.5	0.95	91.3	365	0	0.0	1,145	0	0.0
Control ..	97.7	90.5	1.13	87.5	175	42	24.0	586	104	17.8
640, 3 oz. ..	99.0	92.7	0.90	92.0	368	2	0.5	1,180	7	0.6
Control ..	97.7	90.0	1.04	87.0	174	42	24.1	571	102	17.8
640 S, 6 oz. ..	99.3	93.5	0.85	89.7	359	7	2.0	1,135	12	1.1
Control ..	97.7	92.0	1.08	88.0	176	16	9.1	571	45	7.9
13, 3 oz. ..	99.3	93.3	0.76	94.7	379	3	0.8	1,165	7	0.6
Control ..	97.7	91.5	1.12	91.5	183	27	14.8	545	64	11.7
30, 3 oz. ..	99.0	93.3	0.87	93.0	372	12	3.2	1,138	33	2.9
Control ..	97.7	93.5	1.06	94.0	188	24	12.8	583	60	10.3
1 dust, 1 oz. ..	98.7	94.5	0.75	94.3	377	1	0.3	1,160	2	0.1
Control ..	97.7	88.0	0.83	83.0	166	28	16.9	528	64	12.2
1 steep, 0.2 per cent.	99.7	94.5	0.99	91.5	366	1	0.3	1,108	1	0.1
Control ..	97.7	89.0	1.14	88.0	176	32	18.2	595	86	14.4
in. 0.25 per cent. ..	97.7	93.3	0.72	93.3	373	2	0.6	1,271	4	0.3
Control ..	97.7	89.0	1.21	89.5	179	40	22.4	629	103	16.4
a, 0.25 per cent. ..	99.3	95.5	0.99	93.0	372	1	0.3	1,244	1	0.1
Control ..	97.7	91.0	1.03	92.5	185	42	22.7	648	113	17.4
s Protector, 7.7 per cent.	82.7	65.7	1.66	68.7	275	0	0.0	1,010	0	0.0
Control ..	97.7	88.5	1.01	88.5	177	33	18.6	641	91	14.2
ne, 1 per cent. ..	54.7	38.5	1.48	46.5	186	0	0.0	798	0	0.0
Control ..	97.7	91.5	1.20	91.5	183	44	24.0	688	122	17.7
me, 2 per cent. ..	34.7	27.0	1.44	29.5	118	0	0.0	727	0	0.0
Control ..	97.7	86.0	1.21	83.0	166	29	17.5	689	88	12.8
in, 1–320 ..	99.7	69.3	1.31	69.5	278	0	0.0	1,076	0	0.0
Control ..	97.7	84.0	1.08	83.0	166	42	25.4	635	133	21.0
in, 1–480 ..	97.3	74.3	1.76	76.0	304	0	0.0	1,155	0	0.0
Control ..	97.7	90.5	1.17	90.5	182	47	25.8	669	129	19.3
in presoak, 1–320 ..	100.0	82.7	1.32	80.5	322	0	0.0	1,282	0	0.0
Control ..	97.7	86.0	..	83.5	167	38	22.7	738	131	17.8

College Hunter's.

Treatment.	Percentage Germination. In Laboratory.	In Field. First Count. %	In Field. First Count. PE ±	In Field. Mature Plants.	Plants. Total.	Plants. Smutted.	Plants. Percentage smutted.	Heads. Total.	Heads. Smutted.	Heads. Percentage smutted.
Control ..	98.7	96.0	0.78	92.0	184	34	18.5	747	112	15.0
carbonate No. 1, 4 oz.	100.0	91.3	0.90	87.3	349	0	0.0	1,407	0	0.0
Control ..	98.7	90.0	0.80	89.5	179	57	31.9	763	173	22.6
carbonate No. 2, 2 oz.	98.7	91.3	0.83	90.3	361	0	0.0	1,550	0	0.0
Control ..	98.7	91.5	1.12	91.5	183	56	30.6	756	184	24.3
640, 3 oz. ..	99.3	92.5	1.15	91.5	366	2	0.6	1,597	2	0.1
Control ..	98.7	88.0	1.26	86.0	172	57	33.2	874	219	25.0
640 S, 6 oz. ..	99.0	89.7	1.03	90.3	361	35	9.7	1,583	121	6.6
Control ..	98.7	90.5	1.25	92.5	185	35	18.9	746	108	14.5
13, 3 oz. ..	99.3	92.5	1.08	91.0	364	2	0.5	1,498	5	0.3
Control ..	98.7	90.0	1.07	87.5	175	48	27.4	726	136	18.8
30, 3 oz. ..	99.7	90.5	1.21	92.3	369	17	4.6	1,467	47	3.2
Control ..	98.7	89.5	0.89	86.5	173	36	20.8	701	113	16.0
1 dust, 1 oz. ..	99.7	88.3	1.03	87.3	349	0	0.0	1,386	0	0.0
Control ..	98.7	88.5	1.12	86.5	173	26	15.1	701	75	10.7
1 steep, 0.2 per cent.	99.0	89.7	1.38	87.7	351	3	0.9	1,418	10	0.7
Control ..	98.7	92.0	1.34	92.0	184	35	19.0	750	114	15.2
in. 0.25 per cent. ..	97.7	91.3	0.86	89.7	359	0	0.0	1,338	0	0.0
Control ..	98.7	89.5	1.15	88.5	177	48	27.2	695	147	21.2
a, 0.25 per cent. ..	99.3	91.0	1.10	91.0	364	2	0.6	1,449	5	0.3
Control ..	98.7	91.5	0.65	90.3	181	52	28.6	738	170	23.1
s Protector, 7.7 per cent.	93.3	79.3	1.49	79.0	316	0	0.0	1,376	0	0.0
Control ..	98.7	92.5	0.82	89.5	179	29	16.2	815	93	11.4
ne, 1 per cent. ..	81.0	61.0	1.11	60.3	241	0	0.0	1,268	0	0.0
Control ..	98.7	90.5	1.00	90.0	180	39	21.7	804	135	16.8
me, 2 per cent. ..	57.3	45.3	1.55	48.5	194	0	0.0	1,076	0	0.0
Control ..	98.7	94.0	0.82	94.5	189	37	19.6	750	105	14.0
in, 1–320 ..	97.7	83.7	1.22	85.0	340	0	0.0	1,267	0	0.0
Control ..	98.7	94.0	0.70	96.0	192	21	10.9	699	61	8.6
in, 1–480 ..	98.0	86.3	1.41	87.3	349	0	0.0	1,240	0	0.0
Control ..	98.7	92.0	0.70	91.5	183	17	9.3	707	50	7.0
in presoak, 1–320 ..	99.3	87.5	1.06	85.7	343	0	0.0	1,330	0	0.0
Control ..	98.7	91.0	..	91.5	183	16	8.7	730	53	7.2

Solid-straw Tuscan.

Treatment.	Percentage Germination. In Laboratory.	In Field. First Count. %	In Field. First Count. PE ±	In Field. Mature Plants.	Plants. Total.	Plants. Smutted.	Plants. Percentage smutted.	Heads. Total.	Heads. Smutted.	Heads. Percentage smutted.
Control ..	98.0	92.0	1.08	89.5	170	15	8.4	580	42	7.2
carbonate No. 1, 4 oz.	98.0	94.3	1.08	92.3	369	0	0.0	990	0	0.0
Control ..	98.0	94.0	1.06	90.5	182	3	1.6	485	5	1.0
carbonate No. 2, 2 oz.	97.3	92.5	0.92	91.5	366	0	0.0	1,019	0	0.0
Control ..	98.0	93.0	0.92	90.5	181	7	3.8	501	12	2.4
640, 3 oz. ..	98.7	94.0	0.70	93.7	375	0	0.0	1,025	0	0.0
Control ..	98.0	94.0	0.80	94.0	188	6	3.2	521	13	2.5
640 S, 6 oz. ..	95.7	94.7	0.70	94.0	376	1	0.3	1,002	2	0.2
Control ..	98.0	92.5	0.91	92.5	185	3	1.6	471	4	0.8
13, 3 oz. ..	97.7	94.3	0.68	93.7	375	0	0.0	893	0	0.0
Control ..	98.0	93.0	0.90	90.5	181	9	5.0	418	12	2.8
30, 3 oz. ..	97.0	91.5	0.90	90.5	362	0	0.0	838	0	0.0
Control ..	98.0	94.0	0.80	93.5	187	6	3.2	404	12	2.9
1 dust, 1 oz. ..	97.7	94.5	0.60	94.5	378	0	0.0	889	0	0.0
Control ..	98.0	93.5	0.90	92.5	185	8	4.3	421	19	4.5
1 steep, 0.2 per cent.	97.7	94.0	0.95	93.0	372	0	0.0	915	0	0.0
Control ..	98.0	89.5	1.06	91.5	183	7	3.8	450	14	3.1
in. 0.25 per cent. ..	99.3	94.3	0.68	92.3	369	0	0.0	925	0	0.0
Control ..	98.0	94.5	1.08	90.0	180	1	0.5	426	1	0.2
a, 0.25 per cent. ..	99.0	93.7	0.61	90.3	361	0	0.0	872	0	0.0
Control ..	98.0	94.5	1.09	87.5	175	2	1.1	428	2	0.4
s Protector, 7.7 per cent.	93.7	88.3	1.07	70.3	281	0	0.0	737	0	0.0
Control ..	98.0	91.5	1.05	88.0	176	11	6.2	435	17	3.9
ne, 1 per cent. ..	83.0	87.7	1.07	82.5	330	0	0.0	798	0	0.0
Control ..	98.0	92.0	0.79	90.5	182	11	6.0	456	15	3.3
me, 2 per cent. ..	69.7	87.7	1.07	75.0	300	0	0.0	782	0	0.0
Control ..	98.0	91.0	1.11	90.5	181	10	5.5	447	19	4.2
in, 1–320 ..	95.3	89.7	1.09	87.5	350	0	0.0	849	0	0.0
Control ..	98.0	86.0	1.10	87.0	174	13	7.5	422	21	5.0
in, 1–480 ..	95.7	89.7	0.90	87.5	350	0	0.0	731	0	0.0
Control ..	98.0	90.5	0.78	90.0	180	5	2.8	402	8	2.0
in presoak, 1–320 ..	99.3	90.7	0.84	*90.3	271	0	0.0	641	0	0.0
Control ..	98.0	88.0	1.10	88.5	177	10	5.6	465	18	3.9

* Three rows only.

were all harvested in Canterbury in 1925. The Velvet Chaff and College Hunter's varieties were sown 6-10/6/25, the Solid-straw Tuscan 19/8/25. All were dusted (1-750) with spores of *Tilletia Tritici* Wint. collected in 1925 from Solid-straw Tuscan wheat at Ashburton.

The formalin, bluestone, and Clarke's Wheat Protector treatments were done the same day as sown, the other treatments from three to ten days beforehand. First count: Velvet Chaff and College Hunter's, 17/8/25; Tuscan, 16/10/25. Plants finally pulled and counted, 20-26/1/26.

All the field-work was again carried out at the Ashburton Experimental Farm.

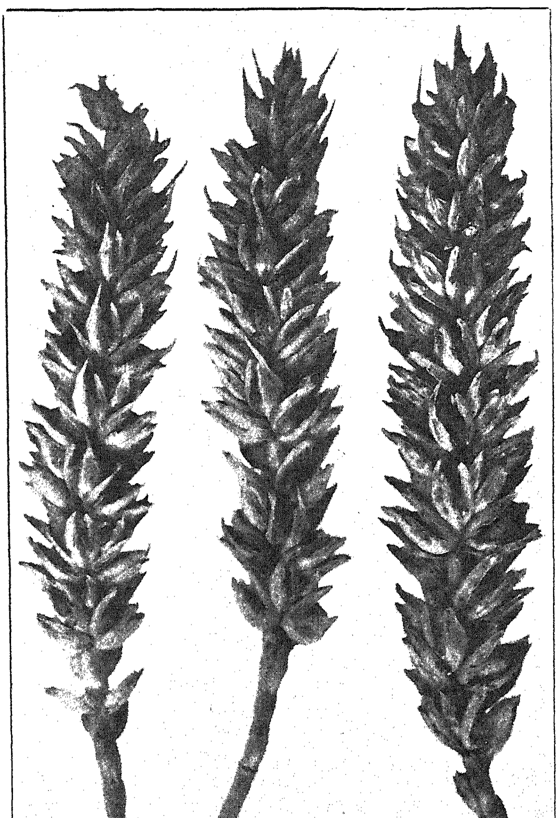


FIG. 1 (LEFT). STINKING-SMUT OF WHEAT (TILLETIA TRITICI).

Spore masses in ovaries of wheat inflorescences. Although infected, these heads appear to differ in appearance little from the normal, save that the glumes are forced apart somewhat.

FIG. 2 (RIGHT).

The glumes have here been removed so as to expose infected grains, and these have been sectioned to show the spore masses.

[*Photos by H. Drake.*

THE PROGRESS OF ECONOMIC ENTOMOLOGY IN AUSTRALIA AND NEW ZEALAND.

(Concluded.)

Presidential address to the Biology Section of the New Zealand Institute Science Congress, Dunedin, January, 1926, by Dr. R. J. TILLYARD, Cawthron Institute of Scientific Research, Nelson.

II. THE CONTROL OF NOXIOUS WEEDS BY INSECTS.

I TURN now to the second type of problem mentioned at the beginning of the main part of my address—namely, that of control of noxious weeds by their insect enemies. Until quite recently this was almost a virgin field, as the only work that had been done along these lines was the control of lantana in the Hawaiian Islands by means of a lycaenid butterfly and a small fly. These insects attacked the buds and the fruit of the weed, with the result that it was quickly prevented from further spreading; what was already there was grubbed out in very thorough fashion, except in inaccessible places, and the menace is now entirely removed. Those of you who know the hold that lantana has obtained along the east coast of Australia will agree that this achievement was in itself a notable one.

My predecessor in this chair, Professor T. Harvey Johnstone, of Adelaide, gave us for his presidential address at the combined Wellington meeting in 1923 the subject of control of prickly pear by means of its insect and fungus enemies. It is not my intention here to deal with this problem as fully as he did, but it is necessary that I should summarize for you the course of events, and should also bring the account up to date by including the very latest developments. For this purpose I have obtained from the Institute of Science and Industry in Melbourne, through the courtesy of the Director, Sir G. H. Knibbs, a number of advance copies of the new Prickly Pear Bulletin, which gives a full report of the first five years' work of the Board. This report has been supplemented by letters from the retiring officer in charge, Mr. W. B. Alexander, and from the present officer in charge, Mr. L. F. Hitchcock, giving further details of progress made since the report was completed. Thanks to the courtesy of all these gentlemen, I am able to give you an account which brings this remarkable piece of scientific work right up to date.

In the early years of the work, before the method of control by insects was tried out, both chemists and inventors had a try at the problem. Various suggestions were made for the utilization of prickly pear commercially, but they all failed through the enormously high percentage of water in the plant, the small amount and poor quality of the fibre, and the very low fodder value. Then came the idea of a drastic mechanical attack on the pear—*e.g.*, by driving huge tanks at or through it, crushing it into the ground, and automatically ploughing it in at the same time. This was also a failure. The chemists discovered certain arsenical compounds which would destroy the pear at a cost estimated to make the project a commercial success, and a company known as "Cactus Estates, Limited," was

floated to deal with pear-infested land. This company took contracts to clear given areas of land at a quoted price per acre. I believe they lost money on every contract which they took; the cost of dealing with the pear was always higher than the contract price, and in some cases approached very close to the actual value of the land itself per acre. Thus this very laudable effort failed also. Australia was then left in this desperate position: Here was a pest which already occupied an area of land in Queensland and northern New South Wales as big as the whole of Tasmania, and was increasing at the rate of a million acres a year! Unless some remedy were found, in less that a hundred years' time eastern Australia might consist of a wilderness of prickly pear and a series of walled cities fighting for their very existence against it! The vision of this dire calamity approaching was enough to overcome even the prejudice against the use of insect enemies, and so entomologists were sent abroad to all the cactus lands in America to find enemies of the pest and bring them into Australia.

The first point to notice is the method adopted to prevent any possibility of damage being done to plants of economic value by the introduction of these insects. Permits were only granted for introduction into approved research stations, where the insects had to be bred in closed insectaria and cages. At the same time tests were to be carried out with each insect on as many plants of economic value as possible, with a view to finding out whether they would attack anything besides prickly pear. It is interesting to note that out of more than thirty insects introduced not a single one has yet been found which would eat anything else besides prickly pear, while a large number of them will only attack certain species and varieties of the prickly pear, leaving others quite unharmed.

I wish to emphasize the details of this work here, because it has a very important bearing on a problem of the greatest moment to New Zealand—namely, the control of blackberry. As there is to be a separate discussion on the subject of the blackberry pest I will not deal with it fully here.

The second point which I wish to emphasize is one that is often overlooked. Plants and insects have been evolving together for countless ages, and their interactions one with another are very complex, showing all degrees of specialization. The fossil record shows us that these relationships were much the same three million years ago as they are at the present day. In other words, the insects reached the zenith of their evolution long before mankind came on the scene. This condition of equilibrium between plant and insect life can be, and often is, upset by man in pursuit of his own schemes; but it is not generally realized that every change that has been brought about by this means has been actually within the power of man to grant or to withhold. It is only ignorance or lack of care on man's part which gives the insect its opportunity to become a pest. I cannot give a better example of this than the famous case of the gipsy-moth, *Porthetria dispar*. This moth was a native of Central Europe, and was known to have been the cause of serious damage to various forest, orchard, and shade trees, especially in Germany. Nevertheless, because of its fine silken cocoon, which possessed a possible commercial value, it was deliberately introduced into Massachusetts in 1869 by a French

scientist, whose intention was to establish a silk industry with it, using it in captivity only. The moth, however, was allowed to escape through carelessness. Let it be said to his credit that the scientist at once advertised the fact by every means in his power, pointed out the dangerous character of the insect, and implored the State Legislature to take action against it. Entomology "cut no ice" at all, even in America, in 1869, and people took no notice of the warnings. A few years later the good folk of Boston began to notice marked defoliation of their beautiful trees, and it was found that this moth was spreading far and wide, carrying destruction in its wake. In spite of millions of dollars which have been spent in the effort to check the pest it is still spreading, and has recently reached Canada and New York State.

In Europe the gipsy-moth feeds on a variety of trees and shrubs, such as oak, apple, willow, &c., but pines of all kinds are entirely immune from it. In America the same thing occurs. Pines, both native and introduced, are immune, and the moth confines its attention to the introduced hosts on which it originally fed, and to those American species which are closely related to them, such as pin-oak, red-oak, maple, &c. Now, this moth is one of the most generalized feeders known; the female lays its eggs almost anywhere, and at no stage of the life-history does there appear any tendency to restriction of diet. Yet under the new conditions the immunity of pines from attack held good.

The lesson we can learn from this is that in dealing with an insect we are dealing with a stabilized type. If we know its habits under natural conditions we can be fairly sure of its behaviour under any new set of conditions. If we introduced the gipsy-moth into New Zealand we could state with certainty that it would not touch any of our introduced or native pines and taxads, and we could with equal certainty name all the introduced trees which it would attack, and also those native trees which it would most probably attack too.

Nevertheless it is right that we should insist, as biologists, that in every case of the introduction of a plant-feeding insect very thorough experiments should be carried on to determine the exact limits of its feeding-capacity before any attempt is made to utilize such an insect in the open.

Now, to come back to the prickly-pear problem, the method adopted by the Australian scientists in testing their insects is that known as the starvation-test method. It is well known that every organism struggles to go on living, and searches eagerly for the food necessary for it to live. Any insect will attempt to eat unaccustomed food rather than starve to death, if it can possibly do so. A brood of larvæ, therefore, is taken and divided into two equal parts; one of these is put into a cage in which there is a supply of prickly pear, and the other into a cage in which the only food supplied is the plant to be tested—say, pumpkin. The relative behaviour of the two lots of larvæ can then be noted. Both will rest until the time comes for them to feed. Then those on prickly pear will go ahead, while those on the other plant, urged on by an equal desire for food, will wander over the unaccustomed plant searching for their normal food. As hunger increases they must do one of three things: (1) They may feed on the new plant, find it digestible, and continue to feed and grow on it;

(2) they may eat the new plant, find it indigestible, and turn sickly, finally dying of indigestion or starvation; (3) they may absolutely refuse to touch the new plant, dying straight out from starvation.

Other things being equal, it is found that young larvæ are less likely to attack a new plant than older larvæ. The latter, having much stronger jaws, will sometimes, driven by hunger, eat into an unpalatable plant in the vain attempt to obtain sustenance from it before dying of indigestion or starvation; whereas in young larvæ the inherited instinct is usually so strong that they refuse to touch the new plant, even if their jaws are strong enough to gnaw it or to pierce it. In the case of the prickly-pear insects a few of the older larvæ made slight attempts to eat unaccustomed plants, but the effects were very soon visible in the form of severe indigestion, followed by death.

The first insect introduced into Australia was the cochineal insect, *Dactylopius indicus*. This, soon after it was liberated, entirely destroyed some thousands of acres of one species of prickly pear, *Opuntia monacantha*, but was quite ineffective against the commonest pest pear, *Opuntia inermis*, and the other species present in Australia. A search was therefore made for other species of *Dactylopius*, and several of these were introduced and tested. One of these, *D. tomentosus*, showed such good results on *Opuntia inermis* in captivity that it was the first of the new lot of insects to be liberated in 1923. This insect is now doing wonderful work in the field, both in Queensland and New South Wales. The Governor of Queensland, Sir Matthew Nathan, was so impressed with the results in the Blackall district that he suggested that this insect should be distributed by the train-load! A permanent staff is now engaged in packing and distributing this insect to all parts of Queensland where prickly pear exists. There are already numerous places where, instead of the impenetrable thicket of prickly pear that has existed for the past twenty or thirty years or more, the work of this tiny little insect in the course of only a year or so has opened the thicket up sufficiently for men to get through it with ease; in other cases, where the insect has been at work longer, a team of horses can be driven over the ground; and in a few cases the pear has been entirely cleared and the ground put into cultivation.

A curious point about this insect is that it is impossible to predict in what areas it will succeed and in what areas it will fail. Apparently in some places the pear is too tough for its tiny beak to penetrate, and there it fails to do any good. In some areas it attacks the pear equally well both in scrub and in the open, while in other areas it cannot get a start on either. It is generally admitted now, after seeing its work during the last two or three years, that this insect will be one of the main factors in clearing the pear from very large areas in both States.

No other insect has been liberated as yet for so long a time as *Dactylopius tomentosus*. The next most effective species appears to be the red mite, *Tetranychus opuntiae*, which has only been liberated quite recently in three or four areas. A. P. Dodd, who has recently been promoted to the position of officer in charge of the investigations, considers this the most destructive enemy of prickly pear known so far.

The large coreid bug, *Chelinidea tabulata*, which I saw in immense numbers in the cages at Sherwood in 1923, is a most formidable insect which looks at first sight much too dangerous to be liberated in any country. It was tested out, I believe, on no less than seventy-eight plants of economic importance before permission was given to liberate it. It confines itself entirely to the genus *Opuntia*, and increases at an incredible rate. Its attacks make the plants sickly and greatly reduce the amount of fruit produced. Though it is a far more spectacular insect than the cochineal it never seems to produce fatal results. It is now being spread in all directions throughout Queensland, and many of those who have observed its work consider that it will be one of the main factors in the subjugation of the pear.

Two other species of *Chelinidae* and one of *Narnia* were also brought into Australia, but failed to increase in captivity to any extent. They have not been liberated.

Of caterpillars which feed on cactus, species of *Melitara*, *Mimorista*, and *Cactoblastis* have been experimented with. Only two have so far been liberated — namely, *Melitara junctolineella* and *Mimorista flavidissimalis*. The former is spreading rapidly, but its effect in reducing the pear is not very great. The latter increased well at first, but none has so far been seen this summer. One of the latest introductions is the moth, *Cactoblastis cactorum*, from the Argentine. In captivity this has proved much more destructive than any species of *Melitara*, and also it is a much hardier species and easier to breed in confinement. It has increased at a prodigious rate, and liberations are about to begin. Judging by its effect in captivity this insect, when liberated, should rapidly become one of the leading agents in the destruction of the pest.

Some large longicorn beetles of the genus *Moneilema* were introduced, but were found to be difficult to rear in captivity. Later on it was discovered that an egg-parasite had been introduced with them. This insect had to be eliminated and a fresh start made. Up to the present these beetles have not increased sufficiently to enable liberations to be made. The flightless weevil, *Gerstaeckeria basalis*, has also been acclimatized in cages, but not yet liberated. Several other species of beetles have been introduced, but failed to become acclimatized.

It is of special interest to note that, so far, only one enemy has made its appearance in the field, and that is our old friend *Cryptolaemus montrouzieri*, the ladybird beetle which is a well-known enemy of mealy bug. This insect has been attacking the cochineal insects, but, so far as at present can be ascertained, the cochineal increases at a much greater rate than the ladybird, and the latter has had no appreciable effect on it.

In the newly published bulletin on the Natural Enemies of Prickly Pear accounts are also given of a number of fungus diseases and a bacterium which are being experimented with. None of these has so far been liberated. Unlike the insects, the bacterium, *Bacillus cacticidus*, when tested on other economic plants was found to produce a very serious disease in squashes, melons, and marrows. The fungus, *Gloeosporium venetum*, caused a rot to develop in apples within twenty-four hours. Two other species of *Gloeosporium*, one of *Hendersonia*, one of *Macrophoma*, and one of *Macrosporium* have

been tested without causing injury to any economic plants. None of these, however, has as yet been liberated, and it is unlikely that they will play any effective part in the control of the pest in future.

The general opinion at the present time in Australia is that the problem is in course of solution by the utilization of the insect enemies alone. A few years back the then Minister for Lands in New South Wales, visiting the prickly-pear laboratory in the north-west of that State and seeing the work that was beginning there with the insects, remarked that it was the one bright spot in an otherwise hopeless situation. In 1925 the officer in charge of the principal laboratory in Queensland was able to write as follows: "There is now no doubt at all, in our opinion, that in time, by biological means, we shall surely control the prickly-pear pest in Australia."

Prickly pear has laid waste more land than any other pest plant in any part of the world. Its subjugation appeared a hopeless task until the leaders of thought in Australia took courage and decided to utilize the insect enemies to control it. The cost of the work to date has been £40,000, and the total cost before Australia is freed from pear may well amount up to £100,000. The area of land infected is approaching thirty million acres, and is increasing at the rate of one million acres a year. Even if we place a very low average value on this land—say, £10 per acre—there are three hundred million pounds of capital locked up in the infested land and a further ten million pounds' worth going out of action every year. To rescue three hundred million pounds' worth of land in the course of ten or even twenty years at a cost of £100,000 would be a wonderful achievement from whatever angle you may choose to view it, and if it is done by means of the insects, as it appears at present that it will be done, entomologists will be able to claim to their credit one of the greatest triumphs of the human race.

The control of plant pests is one of the outstanding problems of the present day, and one of the most difficult. A plant which to-day is a mere curiosity, of which nobody takes any notice, may in ten years time be a pest, and in twenty years time a menace to the life of a whole community. In Victoria the St. John's wort, *Hypericum perforatum*, has seized and occupied an entire valley of previously fertile country eighty miles in length. In New Zealand and in Australia alike blackberry is spreading at an alarming rate. Who shall say what will be the worst pests of the future! Why should we tolerate any weed in our midst if science can find a simple way of removing it? Therefore I conclude this address by commending to you all the careful study of the problem of control of plant pests by their natural enemies, and appeal to you not to let fear or prejudice sway you in making a decision on so vital a matter. The advance of entomology as an exact science during the past few years has been phenomenal, and our knowledge is now sufficiently sound and wide to justify us in stating that we are capable of undertaking the study of the control of any plant pest by means of its insect enemies without allowing the slightest possible chance of any damage accruing to our country. All we need is the necessary well-equipped laboratories and insectaria, and enough trained entomologists and assistants to do the work required. In the course of a year or two of work in the

insectarium we can discover without any shadow of doubt what any given insect will do if it were to be liberated in New Zealand. Where a safe remedy can be found against any plant pest in the form of an insect which will attack it without touching any other plant, then it would seem to be a clear duty on the part of those responsible for the welfare of the country to accept the decision of its scientists and encourage the work to go forward.

I am well aware that in the case of prickly pear the pest plant was of such a specialized nature that the chances of its insect enemies attacking other plants as well were reduced to a minimum. In the case of blackberry or St. John's wort this would not be so. The scientist's duty then would be to test out all likely insect enemies in the insectarium, to eliminate at once those which attacked other valuable economic plants, and to continue to work with those which would not attack them. In the case of a very serious pest such as blackberry the final result might be a good chance of control, with risk to one or two related plants such as raspberry and loganberry. In such a case if the prospective gain were enormous beside the prospective loss, or if means could be found to prevent the loss, it would be our duty, in my opinion, to press forward with the work and to check the spread of destructive pest weeds over larger and larger areas of this fair country of ours.

FARM DAIRY INSTRUCTION.

THE SYSTEM EXPLAINED.

Dairy Division.

THE growing popularity of the farm dairy instruction system is well demonstrated by the fact that thirty-eight of these Instructors are now operating in various parts of the Dominion. The number of dairy farms under their supervision is over thirty thousand, producing approximately 60 per cent. of the butterfat made into butter and cheese.

Wherever Farm Dairy Instructors have been operating for some time a very decided improvement in the quality of the milk or cream supply has been noticeable. The farmers are quick to recognize the benefits of the advice and assistance given by these officers, and repeatedly, when trouble with the supply arises, send for the Instructor, in order to obtain his help in locating the cause of the difficulty.

In the past the work of farm dairy instruction has been undertaken by the ordinary instructional staff of the Dairy Division, but during the busy season when this work is most effective the Instructors' time is very fully occupied in connection with the factories, &c. Each year, however, a number of dairies have been visited, and assistance and instruction given in the better care of the milk or cream. The conditions found on many of the farms visited have brought home very forcibly the urgent need of more constant supervision, which can only be obtained by the appointment of an officer who is able to devote the whole of his time to this work.

The appointment of a Farm Dairy Instructor entails no very heavy expense to the dairy company or companies concerned. We estimate that one officer can undertake this work in connection with from five hundred to seven hundred farms. A common practice is for a number of dairy companies to combine in order that the requisite number of farms may be available. In districts where the factories are situated fairly close to each other this grouping system can be worked very satisfactorily.

The salary usually paid to Farm Dairy Instructors is £320 per annum, and where five hundred or more farms are under the officer's supervision the Department of Agriculture has assisted the dairy companies to the extent of providing half the salary, or £160 per year. Where the number of farms falls below five hundred the Department has provided a proportionate subsidy. For example, if the Instructor were serving only two hundred and fifty farms the Department's contribution would be £80.

In addition to their proportion of the salary the dairy companies have to find all the Instructor's travelling and locomotion expenses. We estimate these at about £200 per year, and this amount added to that of the officer's salary of £320 gives a total annual expenditure of £520. Deducting the departmental quota of £160, the net cost of a Farm Dairy Instructor's services to each dairy company or group of dairy companies having five hundred or more suppliers would be £360 per year. This must be regarded as a remarkably small expenditure per milk or cream supplier in proportion to the services rendered.

Where a number of factories are grouped together the proportion of each dairy company's contribution to the total expenses is usually worked out on the basis of the amount of butterfat supplied to each company.

Farm Dairy Instructors are appointed by the Department of Agriculture, so that they have official standing. The Department pays the officer's salary in full, the dairy company or group of companies undertaking to repay to the Department each month their due proportion. The companies find directly all expenses of travelling and locomotion. A few companies employing Farm Dairy Instructors have found it convenient to arrange with the officer to provide his own motor-car and travelling-expenses for a lump sum — say, around £200 per annum. Under this system the companies know exactly what the annual expenditure will be. It is generally conceded, however, that the best plan in the long-run is for the companies to provide the motor-car and expenses.

In the event of any dairy company or group of companies considering the adoption of this service and desiring advice, arrangements will be gladly made for an officer of the Dairy Division to attend any meeting and give full information or other assistance in furthering the movement.

Efficient drainage is a first essential of economic primary production. Soil-fertility is controlled by drainage. Drainage should be provided, where necessary, to make the utmost use of the latent fertility. Before spending money on lime and manure, attention should first be given to the physical condition of the soil by draining.

HIGHER AGRICULTURAL EDUCATION IN GREAT BRITAIN.

Paper read to the Agriculture Section of the New Zealand Institute Science Congress, Dunedin, January, 1926, by W. RIDDET, B.Sc., N.D.A. (Hons.), N.D.D. (Hons.), Professor of Agriculture, Auckland University College.

WHILE university education has been firmly established in Great Britain for many centuries, and the important part played by it in developing the nation has been realized for just as long, it is only within recent times that agricultural science has systematically taken its place in the British university curriculum. Considering that agriculture is one of the oldest arts, and was the main support of the people prior to the industrial revolution, it at first seems strange that no attempt was sooner made to put the art on a scientific basis. The united call of the interested parties had not been made, and naturally the efforts of individuals were unheeded.

However, early in the nineteenth century real earnest attention began to be devoted to agriculture from two distinct sources—firstly, the farmers themselves, and, secondly, scientists interested in agriculture. The former established the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland, bodies which, among other things, interested themselves in the education of the farmer by, in the early stages, offering prizes for essays on agricultural subjects, which were published in their journals, and, later, issuing diplomas to those who satisfied certain examination requirements. Scientists aided the societies by devoting themselves to farming problems which, without fundamental knowledge of science, the farmers could not themselves unravel. The work and teachings of men such as Davy, Liebig, Lawes, and Gilbert comparatively soon became widespread. The activity of the farmers' organizations and of the scientists kindled a flame of enthusiasm which, as it grew in intensity, was reflected in the extension of investigation of agricultural problems, the establishment of agricultural colleges, and, later, the creation of university agricultural departments. The Cirencester Agricultural College was established in 1845. This and the Chair of Agriculture at Edinburgh University established in the eighteenth century (1789) were the only centres of agricultural teaching till near the close of the nineteenth century, when various other colleges were established.

Between the opening of the present century and the beginning of the Great War additional colleges and university departments were instituted. Then with the shortage of food-supplies the enthusiasm for education and research became still greater and the need for the moral and financial support of the teacher and research worker more apparent. Thus upon the cessation of hostilities the number of agricultural teachers was increased, new research institutions established, and county farm schools were brought into being. In the reports of all Commissions set up to inquire into methods of mitigating post-war depression in farming special emphasis is laid on the need for the greater extension of agricultural education and research.

PRESENT-DAY INSTITUTIONS AND ORGANIZATIONS.

At the present time higher agricultural education in Great Britain is provided at ten universities and eight agricultural colleges, so spread throughout the country that they each serve the needs of a definite area. In terms of land under cultivation (including pasture and excluding rough grazing) there is one agricultural college for fully 1,750,000 acres. None of these agricultural institutions is so large as many of those found in some other parts of the world. The number of full-time students seldom exceeds three hundred at any one institute; in many cases the number is much less. Those taking degree courses represent possibly no more than a third of the total number, the remainder being diploma and short-course students.

The maintenance of so many similar institutes involves considerable expense, and to some extent the replication of land, buildings, staff, stock, and equipment. With a comparatively limited grant from the national exchequer, the institutes to some extent handicap each other in procuring additional equipment, particularly expensive delicate apparatus, for the development of investigational work. On account of these factors and in the light of American experience it has been suggested that it would be better to reduce the number of existing teaching colleges and provide the others with more accommodation and better equipment. In opposition to this argument it is pointed out that, in addition to the difficulties coincident upon the amalgamation of staff, there would be a break in contact which the colleges have already established with the farming community; there would be a lesser number of research workers and less variety in their efforts, and although the present system is costly the population is great enough to support it.

The administration and organization of the various institutions differ considerably. The agricultural departments are integral parts of the universities, and therefore controlled by their Councils. The colleges, on the other hand, are usually governed by a composite body drawn from all organizations contributing towards their financial support — namely, various County Councils and Education authorities within the limits of the college area, certain farmers' organizations, and the affiliated University Council. It has recently been recommended by a departmental Committee that, *inter alia*, a standing Committee representative of the various teaching and research institutes should co-ordinate all teaching and research work.

The institutions are so organized as to give detailed instruction in each subject associated with agriculture. Thus there are departments of agriculture, agricultural chemistry, agricultural botany, zoology, dairying, bacteriology, economics, veterinary science, engineering, geology, and in some cases horticulture, poultry husbandry, and bee-keeping. Each department is in charge of a professor or principal lecturer, who generally has the assistance of others, each a specialist in one particular branch of the work. Special accommodation and equipment are provided for each department.

With the exception of a few agricultural colleges the institutions are situated in cities, and either form part of the university buildings or are in close proximity to them. They are thus more or less remote from immediate contact with farming, a disadvantage arising from the

establishment of agricultural departments subsequent to the growth of the cities. Such colleges and departments have, however, a farm within reasonable distance of the cities where demonstration and investigational work is carried out. In spite of this the separation of the college from the farm introduces difficulties from both the teaching and the research work point of view. Those colleges not situated in cities are located actually at their farms.

The work of the institutions is not merely confined to teaching. They are also concerned with advisory, research, and extension work. All carry out advisory and routine work for the areas they serve. The various departments generally undertake a certain amount of research work, varying in extent according to the number of staff and time at disposal; field experiments and feeding trials are carried out at the college farms. In addition, in Scotland, Wales, and parts of England the central college or university department, as the case may be, is responsible for all extension work. This system came into being as the result of extension work following upon the establishment of central institutes. The country is divided into college areas, and each institution appoints one or more instructors to each county. The instructor supervises demonstration areas in selected parts of the country, carries out local field trials, gives advice to farmers, and conducts short courses in agriculture (generally in the evening) at selected centres, so that each farmer may keep in contact with him. By this method the county instructor keeps in close touch with the farmer on the one hand and recent developments in the central college on the other.

Extension work in other parts of England is carried out by organizers appointed by the County Councils. These operate in the same way as the instructors already referred to, but they are not directly responsible to any central college. A recent development has been the appointment of advisory officers to nearly all institutes. These men really act in the dual capacity of local research workers and special advisers. A certain number is attached to each institute, and they each specialize in a branch which is of particular local interest. Problems which fall beyond the scope of the county organizer are referred by him to the advisory officer, who has the necessary accommodation and equipment for their solution. In this way the college can continue teaching as well as its original investigational work, while the county organizer advises the farmer and the advisory officer deals with local troubles as they arise.

In addition to these agricultural teaching institutions there are ten institutions, each under an independent governing body, devoted entirely to research work. Practically all teaching and investigational work in Britain is carried out by the universities, agricultural colleges, and research institutes.

The direct influence which this higher agricultural training has had on British agriculture can scarcely be stated in figures. There is no doubt that it has benefited every farmer by the improvement in varieties of crops, better seed, better grass-mixtures, balanced manures, improved methods of feeding, and in various other ways. Not every farmer had a college training, nor even attended extension lectures; yet all have benefited through the better seeds, fertilizers, and foods on the market, the example of the most progressive in their district,

or even talks with friends whose information may be many-handed. A recent striking example of what can be done is the greatly increased returns and economies effected from the systematic rationing of dairy cows within the past four years. Milk-records have been greatly increased and costs of production decreased. This has been brought about in three successive steps: (1) By patient research work into the actual requirements for milk-production and the value of the various elements; (2) the application of this fundamental research to practice; and (3) the spread of the knowledge so ascertained. Without the fundamental work the extension efforts would have lacked accuracy and possibly created lack of confidence. Without extension work the usefulness of the fundamental success would have been lost.

COURSES OFFERED AT THE INSTITUTIONS.

Courses are designed to meet the varying need of students. Some intend to fit themselves as general agricultural advisers and organizers; a few prefer to select some particular branch of the subject in which they specialize, with the object of later taking up research work; many take a long course at a college to better prepare themselves as farmers or estate agents; and others merely desire a short farmer's course to familiarize themselves with the elements of agricultural science. Thus four types of courses are pre-eminently required. The first two (the general adviser and the specialist) take a full degree course; the third may either take the degree course or simply the shorter diploma one; the fourth takes a short applied course.

In all cases an attempt is made to teach the subject in accordance with its component parts, as an art, a science, and a business. The extent of study in any one of these particular branches is determined by the nature of the course pursued. The future adviser is acquainted with the best art of performing all operations, and has a sound fundamental knowledge of all sciences related to agriculture and their application to farming, together with a good training in the economics of the business. The specialist gets a broad training in the art of agriculture and the business of farming, while he studies in greater detail than the adviser the special branch he later expects to follow. The diploma student is familiarized with the principles underlying all operations and methods without being required to undertake detailed laboratory technique beyond that essentially required in the study of the fundamental sciences, and his attention is especially directed towards improved farming methods and farm-management. The short-course student is taught the principles of agricultural science in a popular way; the most approved practices are brought to his notice, and he is given an opportunity of studying many useful aspects of his business, such as machinery, surveying, book-keeping, and veterinary hygiene, which under ordinary farming-conditions are beyond his opportunity of learning.

No matter which course is taken, a sound practical training is insisted upon. The minimum requirement is twelve continuous months' residence and work on a farm, which work must meet with the approval of the director of the school of agriculture. In some cases this work must be performed before entering upon the course, in others before studying the applied subjects. Students are examined in their farming

experience orally and, if considered advisable, practically. No attempt is made to teach practical agriculture at the college farm, as this would upset experimental work, and it is considered that not only can the student get more practice working as an ordinary farm hand, but he is also made more familiar with the actual conditions with which the farmer has to contend. This aspect is particularly important for those later intending to be organizers and farmers. Different methods of performing operations are carefully explained and compared in the class, and, where necessary, demonstration is given. Any desiring practical instruction can get this at the County Farm Institute.

Those intending to take degree courses are required to pass the same university matriculation examination as other science students. No entrance examination is required of diploma or short-course students, though a minimum age-limit of seventeen years is generally insisted upon.

Degree Course.

Two agricultural degrees are granted by most universities—namely, Bachelor of Science in Agriculture and Bachelor of Science in Agriculture with Honours. The honours degree was introduced within the last two years to meet the needs of students intending to take up research work. Thus those who later intend to seek positions as agricultural organizers or to follow out farming for themselves take the ordinary course, while those who prefer to take up specialized work or aim at teaching in central institutes study for the honours degree. The former necessitates a course of from three to four years, and the latter at least four years. In both cases an additional year's residence on a farm is generally insisted upon.

Though fundamentally alike, the curricula of the various colleges and universities vary somewhat in detail. Generally, both pass and honours students take the ordinary university classes in chemistry, botany, zoology, physics, geology, and economics during their first and second years' study. Thereafter they continue their study in the agricultural department of the university, or, if that is not available, at some agricultural college affiliated to the university first attended. The subjects taken at this stage include agriculture and dairying, agricultural chemistry, agricultural botany, agricultural bacteriology, engineering and land-surveying, agricultural accountancy and economics, veterinary science and agricultural zoology. While all branches of farming are covered by the general term "agriculture," the subject for teaching and examination purposes is divided into field husbandry, animal husbandry, dairying, and farm-management. Students following out the ordinary degree take all these subjects, while those taking the honours degree are required to select one principal subject from among the number and study this in its greatest detail, along with two specified subsidiary subjects chosen so as to be cognate to the principal one. The principal subject must be studied for at least two years at the advanced stage, and a thesis on some aspect must be submitted.

The scope of study is so wide that students need to devote their whole time (apart from vacation) to the work. As already mentioned, no time is devoted at the college by students to farm-work, though

naturally all methods of performing operations are described and demonstrations given where necessary, practical instruction is given in live-stock selection, and frequent excursions are made to well-conducted farms.

Diploma Course.

The diploma course usually covers two or three years. The subjects studied during this course are the same as those for the pass degree, but less time is devoted to detailed laboratory technique. In this case the fundamental sciences are taught at the agricultural college, the students taking their whole course there. Special regulations are usually provided whereby those who have completed the diploma course can, if they so desire, proceed to the degree course without again taking certain applied classes. Such students must, however, submit themselves to degree examinations in all subjects.

Short Course.

The farmers' short course generally extends over the six winter months (October–March). The subjects dealt with include agriculture in all its phases, book-keeping, veterinary hygiene, farm engineering and surveying, farm dairying, and the elements of botany and chemistry. All of these subjects are treated in a popular manner, so that the student gets some insight into the principles underlying agricultural practices and the latest information applicable to general farming.

POST-GRADUATE STUDY AND SCHOLARSHIPS.

In addition to these systematic courses, facilities also exist for post-graduate study. Such study can, if desired, lead to the degrees of Ph.D. and D.Sc. (Agr.). To enable students to undertake post-graduate study scholarships are provided by some universities. This work is of a specialized nature, and is carried out under the direction of the head of a particular department in accordance with the requirements of the scholarship.

While the scholarships are mainly endowments, the Ministry of Agriculture has offered several annually for the past few years. The latter are devoted not only to research work, but also to the training in some special direction of those intending to be county organizers. These scholarships are tenable at any university, and in some cases make provision for one year's study abroad.

Another recent development is the provision by the Ministry of Agriculture and the Development Commissioners of travelling scholarships to enable research workers and teachers in institutes to visit foreign countries and investigate special aspects of any branch of agricultural science. These scholarships are very highly appreciated, as they provide a means of establishing international interest in agricultural problems and discussing methods and results with co-workers in other countries. More useful and greater progress can thereby be made than by the mere perusal of publications. Besides, the visits permit of study being made of commercial practices in these foreign countries which, with adaptations, can often be applied with advantage at home.

OTHER ASPECTS.

Although the total number of openings for graduates in agricultural science is more limited than for those in pure science, in proportion to the number seeking appointments agricultural graduates are just as fortunate as others. Some are appointed to the teaching staffs of colleges and university agricultural departments; some receive appointments at farm institutes and as assistant county organizers; several become technical advisers and analysts to commercial firms; an increasing number is absorbed by research institutes, which have of recent years been considerably increased; the Government departments provide employment for a certain number annually; the agricultural departments of the Crown Colonies provide several annual vacancies; and many return to farming.

So far agriculture has not been systematically taught in day schools, yet at least one county has recently made a departure in this direction, confining instruction to secondary classes, and I believe that the tendency is for this practice to increase.

As regards one of the most important aspects of agricultural education—namely, the total cost—this could scarcely be estimated without inquiring of each institution. Apart from Government grants, revenue is derived from university and college endowments, County Councils, and other public bodies. In addition some of the research institutes have been established by endowment or public subscription augmented by Government grant on a fifty-fifty basis, and are to some extent self-supporting.

Government grants are derived partly from the Ministry of Agriculture and partly from the Development Commission. From the available information it is not possible to distinguish between grants awarded separately to education and research, nor to higher education as opposed to extension work. However, it is worthy of note that the total Government grant for agricultural education and research at present is £700,000 per annum. £200,000 of this amount represents an annual allowance granted for five years on the repeal of the Agriculture Act of 1920. A further £100,000 represents an additional sum granted to augment this amount. In terms of land under cultivation (including pasture, excluding rough grazing) this sum represents £1 per 45½ acres.

If to this sum be added the expense borne by County Councils, endowments, and the like, it will be realized that considerable effort is being concentrated on the scientific improvement of agriculture in Great Britain, although agriculture as an industry is there subsidiary to others as a source of national wealth. In spite of the substantial amount granted it is found that all is needed; indeed, the work of some institutes is restrained for lack of funds.

Superphosphate, in which the phosphate is immediately available when applied to the soil, is particularly valuable in dry climates and on light soils. Slowly available phosphates, such as basic slag and raw ground rock phosphate, are valuable on sour soils and where the rainfall is high. For root-crop growing a mixture of rapid and slowly acting phosphates promotes maximum production.

LIMING AND TOP-DRESSING OF PASTURE AT WINTON EXPERIMENTAL AREA.

RESULTS FOR 1925.

R. McGILLIVRAY, F.L.S., Fields Division, Invercargill.

THE top-dressing of pastures in Southland is a matter of vital importance to the farmers of the province, and the continuation of these experiments at Winton Experimental Area has aroused considerable interest. Many discussions have taken place from time to time as to the kind or combination of fertilizers that should be used to obtain the best results. The answer can only be obtained by means of field tests, and it is for this reason that work of the kind here recorded has been undertaken. The fact that some of the phosphatic fertilizers which have been used have given meagre and tardy results is beyond dispute, but in nearly all cases where suitable mixtures have been used the results have been quite beyond expectations.

The 5-acre pasture block (No. 3) on which the investigation has been carried out was sown in 1920, the seeding per acre being as follows: 40 lb. perennial rye-grass, 6 lb. Italian rye-grass, 2 lb. white clover, and 3 lb. red clover. In 1924 the block was set aside for a top-dressing experiment to test Belgian basic slag against Nauru rock phosphate, each fertilizer being applied at the rate of 3 cwt. per acre across the limed subdivisions as shown on the accompanying plan (next page). Particulars of the first year's results were published in the *Journal* for August, 1925, page 107.

The fertilizers for the second year's tests were applied during July, 1925, at the same rate and in similar manner as in the preceding year. The block was closed up on 1st November for the purpose of ascertaining results. The weighing and collecting of samples was carried out on 1st December in the same way, except that in 1924 only fifty weighings were taken, while in 1925 one hundred were made, as shown on plan. The area weighed for each plot was ½ chain by 4 ft. in width; all weights are again given in ounces. Results are shown in the plan.

In weighing the plots the method adopted was as follows: A two-horse mower was used, and a start was made by cutting a length on the outside of Plot 1A. This was continued with each plot until 1E was completed. A similar weighing was then made in the same plot from A to E, but this time each area cut was along the inside next to the control Plot No. 2. The work was continued in this manner until the completion of Plot 10E. Each area cut was weighed within a period of five minutes, and all samples were taken at the same time.

A botanical analysis was made from representative samples from each series of treatments—not of each individual plot as was done last year. The herbage was much further advanced in growth than was the case at time of weighing on the previous occasion. No very marked difference was found in dry-weight determinations, except

that Plots 2C, 4C, 7C, and 9C showed a greater loss of weight in the drying process than did the herbage from any of the other subdivisions. The basic-slag plots greatly increased their lead of the preceding year over Nauru rock phosphate, and from October onward the slag plots could be picked out from a considerable distance owing to their more abundant growth and the characteristic sheen of the grass. The clover content was also considerably higher and far more robust in growth than in the Nauru plots. Another fact worth noting is that the clovers made a better showing in 1925 on the carbonate-of-lime plots than they did on the plots treated with burnt lime. It is evident that the burnt lime is about exhausted, and that further supplies are required.

	1·8 Tons Carbonate of Lime. A.	3·6 Tons Carbonate of Lime. B.	No Lime. C.	2 Tons Burnt Lime. D.	1 Ton Burnt Lime. E.	Totals.	
	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	
Plot 1 ..	736	784	502	672	640	6,678	Basic slag.
	768	784	512	704	576		
Plot 2 ..	502	576	412	506	352	4,746	Control.
	512	544	460	530	352		
Plot 3 ..	736	888	612	672	576	6,894	Basic slag.
	688	832	602	696	592		
Plot 4 ..	352	600	404	544	380	4,573	Control.
	376	616	382	528	391		
Plot 5 ..	648	815	608	704	584	6,724	Basic slag.
	672	840	596	736	520		
Plot 6 ..	368	512	516	506	336	4,350	Nauru rock phosphate.
	336	496	496	480	304		
Plot 7 ..	380	436	417	420	352	4,057	Control.
	364	452	436	436	364		
Plot 8 ..	328	536	500	530	336	4,344	Nauru rock phosphate.
	336	496	490	496	296		
Plot 9 ..	316	438	432	436	340	3,983	Control.
	336	460	418	461	346		
Plot 10 ..	320	410	448	442	361	4,004	Nauru rock phosphate.
	361	466	408	471	317		

DIAGRAMMATIC PLAN OF THE EXPERIMENTAL BLOCK, SHOWING LIMING AND TOP-DRESSING RESULTS FOR 1925.

The figures given on the plots represent green weights of herbage.

In the following table are set out the average green weights of the manured and control subdivisions under various lime treatments :—

			Oz.
Subdivision	A :	1·8 tons carbonate of lime plus 3 cwt. basic slag	708·0
,,	B :	3·6 tons carbonate of lime plus 3 cwt. basic slag	824·0
,,	C :	No lime ; 3 cwt. basic slag	572·0
,,	D :	2 tons burnt lime plus 3 cwt. basic slag	697·3
,,	E :	1 ton burnt lime plus 3 cwt. basic slag	581·3
Subdivision	A :	1·8 tons carbonate of lime plus 3 cwt. Nauru phosphate	341·5
,,	B :	3·6 tons carbonate of lime plus 3 cwt. Nauru phosphate	486·0
,,	C :	No lime ; 3 cwt. Nauru phosphate	476·3
,,	D :	2 tons burnt lime plus 3 cwt. Nauru phosphate	487·5
,,	E :	1 ton burnt lime plus 3 cwt. Nauru phosphate	325·0
Subdivision	A :	1·8 tons carbonate of lime—control	392·2
,,	B :	3·6 tons carbonate of lime—control	512·2
,,	C :	No lime—control	420·1
,,	D :	2 tons burnt lime—control	482·6
,,	E :	1 ton burnt lime—control	359·6

Now that we have the results of two years as a guide the value of basic slag as a top-dressing at Winton is evident. In 1924 slag gave an increase of about 11 per cent. over Nauru rock phosphate, but it was expected that Nauru would make up some leeway this year. The reverse has been the case, however; the slag has increased its lead very considerably, and in 1925 shows an increase of approximately 60 per cent. over Nauru rock phosphate.

Expressed in ounces, the three basic-slag plots gave 20,296, while the three Nauru phosphate plots gave only 12,698, which is very little more than the weights of the three immediate controls. The basic-slag plots have certainly had the advantage of more added fertility than the Nauru plots, for the reason that the sheep frequent the basic-slag portion of the block to a far greater extent than they do the Nauru plots. This preference has been most noticeable during the past season.

FIG. 1. EWES AND LAMBS (145 ALL COUNTED) GRAZING ON BLOCK 3, WINTON EXPERIMENTAL AREA.

BOTANICAL ANALYSIS.

The following table shows the results of a botanical analysis of the hay from each subdivision of the block. The determinations were based on weights, and to fully understand the table the reader should consult the plan of the block.

Plots.	Grasses.	Clovers.	Other Plants (Weeds).	Plots.	Grasses.	Clovers.	Other Plants (Weeds).
	Per Cent.	Per Cent.	Per Cent.		Per Cent.	Per Cent.	Per Cent.
1A, 3A, 5A ..	78·20	16·80	5·00	6D, 8D, 10D ..	82·90	10·14	6·96
1B, 3B, 5B ..	78·16	16·84	5·00	6E, 8E, 10E ..	82·82	10·08	7·10
1C, 3C, 5C ..	83·20	10·10	6·70	2A, 4A, 7A, 9A ..	86·00	8·00	6·00
1D, 3D, 5D ..	79·96	14·84	5·20	2B, 4B, 7B, 9B ..	83·96	9·00	7·04
1E, 3E, E5 ..	79·93	14·06	6·01	2C, 4C, 7C, 9C ..	85·40	7·40	7·20
6A, 8A, 10A ..	81·57	12·00	6·43	2D, 4D, 7D, 9D ..	83·86	9·22	6·92
6B, 8B, 10B ..	81·40	12·18	6·42	2E, 4E, 7E, 9E ..	83·80	9·00	7·20
6C, 8C, 10C ..	83·34	9·66	7·00				

FIG. 2. TOP-DRESSED FIELD AT WINTON EXPERIMENTAL AREA.

Has been grazed continuously. Alsike and white clover very prominent.

"During the next twenty years, either consciously or unconsciously, the United States will adopt fairly definite policies as to industry and agriculture. We are approaching that period which comes in the life of every nation when we must determine whether we shall strive for a well-rounded, self-sustaining national life in which there shall be a fair balance between industry and agriculture, or whether, as have so many nations in the past, we shall sacrifice our agriculture for the building of cities."—*H. C. Wallace, Secretary of Agriculture, U.S.A.*

A NATIONAL BOTANICAL GARDEN FOR NEW ZEALAND.

PROPOSAL BY INSTITUTE OF HORTICULTURE.

At the midsummer conference of the New Zealand Institute of Horticulture, held at Dunedin in January last, the Hon. G. M. Thomson, M.L.C., moved the adoption of the following remit which had been forwarded by the Dunedin Horticultural Society: "That it is desirable that a New Zealand national botanical garden be established."

Mr. Thomson said that the primary object of such a garden would be to collect and cultivate as large a collection as possible of the plants of the whole world, particularly those remarkable for the beauty of their flowers, foliage, and form, and also those which were of commercial value. The main consideration, next to finance, was climate. Suitable soils could be found to suit the needs of the various plants, but climate could not be controlled, and its variations could be met only to a limited extent artificially. In a cold climate the plants of warmer regions could be cultivated under glass and by means of artificial heat, but in a warm climate it was impossible to cultivate successfully the plants of a colder region. He continued:—

"Every large centre of population should have its botanical garden as an educational institution for old and young alike, contributing not only to the æsthetic tastes and enjoyment of the people, but furnishing a continual object-lesson to all interested in horticulture and in the beautifying of their own homes and of their home towns. The wise custodian of such a garden will carefully limit his efforts to the production of those effects most suited to the climate and conditions of the locality. The ideal botanical garden of the world is Kew, where plants from all parts of the world are collected together, where every appliance of horticultural skill is employed, and where every one can go and learn at first hand what is known of the possibilities of plant-growth. But the object of the resolution which I desire to commend to your notice to-day is not the formation of such a universal garden. Its aim is to gather together a collection of all the indigenous plants of New Zealand, and is exclusive of all exotic species. The reasons for the establishment of a purely national New Zealand botanical garden are very good and sufficient.

"New Zealand is the most distant from any other land area of the large island areas of the world. In one direction only it comes within about 1,200 miles of Australia, the nearest large land area. Northwards it lies still farther from some small island groups in Melanesia and Polynesia; towards the south it is more than twice as far from the Antarctic Continent, where practically no plant-life exists at the present era; while to the east are thousands of miles of deep ocean. This isolation of New Zealand from all other land surfaces took place long ago—how long I cannot state either in years or in terms of geological age. For, while the flora is more allied to that of the Australian than any other region, the separation of the lands certainly occurred before eastern Australia received its eucalypts or its acacias and other characteristic forms, and also before it received any of its mammals. Similarly

there are Melanesian and Polynesian elements in our flora, and more puzzling than any are the South American and Antarctic elements; but all these imply long periods of isolation. The period which has elapsed has given time for the development of many special types of vegetation.

"It is outside the scope of my resolution to go into this subject; but I may just mention such genera as *Myosotidium* in the Chatham Islands, *Pleurophyllum* and *Stilbocarpa* in the Southern Islands, and *Haastia* on our South Island mountains as examples of plants which must have taken very long periods to develop their peculiar and distinctive characters. Now, it is to study all this interesting and fascinating flora that a national botanical garden should be established. Here every type of native plant should, if possible, be cultivated; many of the problems of development could be studied, not only by cultivation, but by experiment. For example: In the new edition of the 'Manual of the New Zealand Flora' the late Mr. Cheeseman enumerates and describes 1,584 species of flowering-plants. It is quite certain that a considerable number of these so-called species—*e.g.*, of *Veronica*, *Celmisia*, *Epilobium*, &c.—are either mere varietal forms, or are hybrids between well-defined species. It will be possible by artificial crossing to establish what are and what are not specific forms; and it is certain also that by such crossing many new and interesting varieties will be raised, of great value from a horticultural point of view. Such a national garden would become to New Zealand what Kew is to the Empire—a place of reference for all sorts of native plants, and a centre of distribution of desirable forms. The possibilities of usefulness are great, and the opportunity should now be taken of impressing on the Government the advisability of establishing such a garden. The expense would be relatively small, especially at the outset, and the station would soon justify its foundation and continuance.

"The next question is one of location. A national garden should be situated near one of the main centres, preferably near one of the University colleges. In considering this question it is all-important to know the composition of our flora. Of the 1,584 species described in the Manual, 192 (or a little over 12 per cent.) are confined to the North Island and do not extend to the South Island. On the other hand, 536 (or nearly 34 per cent.) are confined to the South Island. This is due to the fact, no doubt, that geologically the South Island is much older than the North, and its vegetation has had much longer time to develop distinct forms and races. Again, 360 species (or nearly 22 per cent.) are only met with at or above an elevation of 2,000 ft. on the mountains. Such mountain-plants are always more or less difficult to cultivate at low levels, and are liable under altered conditions to undergo important modifications. Lastly, 109 species are only found in the outlying islands, and of these about one-half come from the subantarctic islands. This great preponderance of southern and mountain forms rules Auckland out at once. Its climate is too warm for these plants. Christchurch is almost equally out of the running; its climate is too cold in winter, and its hot nor'-westers make it very difficult to keep many plants alive throughout the season. I am looking at the question solely from a botanical and horticultural point of view when I affirm that the national garden should either be in Wellington or Dunedin.

"The mean annual temperature of Wellington is 55·3 deg. F., and the rainfall 48·09 in. on 168·8 days. The corresponding figures for Dunedin are 50·6 deg. F., 36·85 in. on 159·2 days. There is not much to choose between them, but Dunedin has less sunshine and more drizzling rain than Wellington. From a gardener's point of view these are not disadvantages. Wellington suffers much more than Dunedin from high winds and gales, but these can be countered to some extent by suitable breakwinds."

In conclusion, Mr. Thomson stated that Dunedin had the land available for such a purpose as that proposed, and that the 65 acres on the Town Belt, above the Botanic Gardens, controlled by the Domain Board, would suit admirably. The city had also a valuable asset in the number of resident botanical and horticultural enthusiasts, several of whom had collections of native plants, especially the mountain varieties, which were not equalled anywhere outside of Otago. From all these points of view, and eliminating all parochial and sentimental reasons, he thought it must be admitted that Dunedin was the most suitable place for such a national botanical garden.

Mr. J. G. McKenzie (Director of City Reserves, Wellington), in seconding the motion, said that there could be no two opinions regarding the necessity of establishing national botanical gardens.

Dr. C. Chilton (Canterbury College) said that he looked on the matter from a scientific point of view. As a teacher of botany he was aware of the difficulties that existed in obtaining living plants for demonstration purposes. It was necessary to stress that scientific men must be in charge of such a garden as that proposed, and which would also provide openings for trained horticulturists. He would suggest that in addition to one central garden there should also be established subsidiary gardens in the various centres. Reciprocity would thus be established between these centres, which would be of great value to the movement. The famous Dutch naturalist, Dr. Lotsy, when recently in New Zealand, was most enthusiastic over the variety of the Dominion's indigenous flora, which was unequalled in any part of the world, and other countries wanted specimens. The difficulty of supplying these would be eliminated by the establishment of a national botanical garden.

After other discussion, in which Messrs. D. Tannock, H. L. Christie, S. T. Tucker, G. A. Green, and Sir G. Fenwick took part, the motion was carried unanimously, and the matter was referred to the executive of the Institute.

Protein, fat, sugars, and starches are the main nutriments contained in crops. In certain crops the percentage of protein is low—wide ratio feeds; in others high—narrow ratio feeds. The dairy cow when in milk requires narrow ratio feeds. Crops in a young vigorously growing condition are generally rich in protein.

Good top-dressed grassland, well provided with clover, provides ideal and cheap feed for dairy cows during the summer. Early mowing—securing a good aftermath—chain harrowing, moderate-sized paddocks, and phosphate top-dressing are the main factors concerned in dairy pasture management.

EXPERIMENTS ON MANURING OF POTATOES IN CANTERBURY, SEASON 1924-25.

F. E. WARD, Instructor in Agriculture, and A. W. HUDSON, B.Sc., B.Ag., Assistant Instructor in Agriculture, Christchurch.

Two experiments in co-operation with farmers on the manuring of potatoes were carried out in Canterbury in the 1924–25 season by the Fields Division.

EXPERIMENT 1: ON FARM OF L. C. BANKS, COUTTS ISLAND, EYRE COUNTY.

Sowing was done on 24th October, 1924; weighings were made on 8th and 9th May, 1925.

Previous crops had been as follows: 1923–24, peas; 1922–23, oats; 1921–22, oats.

The manures used for the experiment were applied in the following order:—

	Quantity per Acre.
(1.) Superphosphate (high grade)	3 cwt.
(2.) Control (no manure).	
(3.) Super and steamed bonedust in equal parts by weight	3 cwt.
(4.) No. 3 mixture, plus sulphate of potash at ¾ cwt. per acre	3¾ cwt.
(5.) Control.	
(6.) No. 4 mixture, plus sulphate of ammonia at ¾ cwt. per acre	4½ cwt.

Each treatment contained five rows of potatoes, the rows being 30 in. apart and about 5 chains long. The series was repeated four times across the field, and may be referred to as series A, B, C, and D. Series A and C had the manure applied with the potatoes at the time of planting, and series B and D had the manures top-dressed four weeks after planting. Unfortunately, circumstances prevented top-dressing being done earlier, and as this appeared rather late the comparison of the two methods was abandoned. However, the yields from each of the methods of application were treated separately, and, while no strict comparisons have been made between the methods themselves, a study of the figures gives some interesting indications of the different behaviour of the manures under the different methods of application.

METHOD OF PLANTING.

The experiment was sown with an O.K. Champion planter, which had an adjustable manure-feed. As usual, the adjustment required to give the desired rate of sowing of manures was ascertained prior to the plots being sown.

COMPARISONS OF YIELD.

Comparisons have been made by Student's method between six paired plots situated side by side in cases where manurial treatments

are compared with controls. Where manurial treatments are compared with one another twelve pairs of plots have been taken. Manured plots compared were either side by side or separated by a control strip only. The three centre rows were hand-dug, and carefully sorted and weighed, the size of the plots being ½ chain long by three rows wide. The potatoes were sorted by hand into "table," "seed," and "small." A particularly fine sample of the largest size was made, thereby reducing the percentage of table potatoes to below what would be regarded as a good marketable sample. The sorting, however, was very uniform throughout, and the high standard attained places a more searching test on the extent to which the fertilizers pay for their application.

OBSERVATIONS DURING GROWTH.

At the time of the top-dressing of two series (four weeks after sowing) the plants on the already manured plots were appearing through the ground, while on the untreated plots very few tops were visible. The manured plots maintained a marked superiority throughout growth, with a very slightly better appearance of the super plots and those having super, potash, and nitrogen.

EVALUATION OF INCREASES.

For purposes of evaluation, table potatoes are reckoned at £3 per ton, and seed at £1 10s. The small potatoes are disregarded, because it is customary for big growers to leave these lying on the ground. The value of "tables" has been arrived at from the fact that the average price for a number of seasons has been about £4 per ton for May delivery.

Allowing 16s. 6d. per ton (eleven bags at 1s. 6d. per bag) for digging by hand (machine digging would cost less) and 5s. per ton as an average cost of carting, the return per ton of increase would be £2 18s. 6d.—say, £3. The value of seed potatoes varies considerably. Pure seed of a good variety realizes up to £8 per ton, whereas ordinary varieties that cannot be regarded as pure are sometimes difficult to dispose of. An average purchase price for such seed seems to be between £2 10s. and £4 per ton, the price being governed largely by the quality and demand for the particular variety. The lower amount is here taken as a basis for evaluation, and the cost of digging and cartage as for table potatoes deducted, leaving the sum of £1 8s. 6d. per ton—say, £1 10s.

That the figure is extremely low is emphasized by the following: Seconds of grain, discoloured samples, &c., are often used as pig-feed when they are difficult to dispose of. Taking the case of barley, this commodity is often of little value in the open market if at all weathered and discoloured. No farmer would think of selling at, say, 2s. 6d. per bushel, but would do quite well if able to purchase at that figure for pig-foods. Now, the price per ton at 2s. 6d. per bushel would be £5 12s. The starch equivalent of barley is 71. So that one unit of starch equivalent of barley would be approximately 1·6 shillings. If one unit of starch equivalent is worth 1·6 shillings, then potatoes—the starch equivalent of which is about 18—would be worth $1 \cdot 6 \times 18 = 28 \cdot 8$ shillings, or approximately 29s. per ton. In

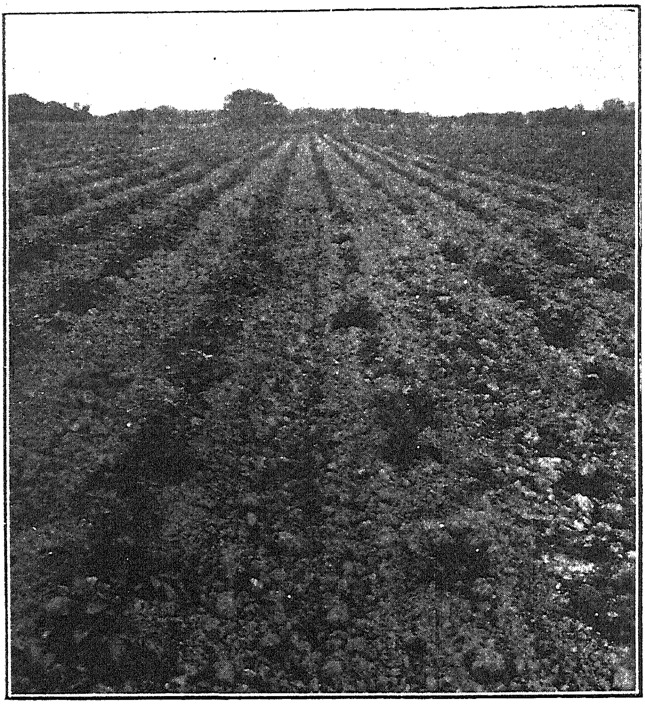


FIG. 1. SOME OF THE EXPERIMENTAL ROWS IN THE GROWING POTATO CROP ON MR. BANKS'S FARM.

On left, complete manure ; on right, control (untreated).

FIG. 2. SHOWING COMPARATIVE YIELDS FROM EQUAL AREAS UNDER THE DIFFERENT TREATMENTS.

Left to right: (1) super; (2) control; (3) super and bonedust; (4) super, bonedust, and sulphate of potash; (5) control; (6) super, bonedust, sulphate of potash, and sulphate of ammonia (complete manure).

addition, the manurial value of potatoes is about 5s. per ton, so that if the farmer regards barley at 2s. 6d. per bushel as a profitable pig-food, then potatoes at 29s. per ton (disregarding the manurial value) will be equally profitable. This fact should be sufficient argument against the practice of allowing small potatoes to lie on the ground and rot.

Table 1.—Series A and C, Manure with Seed: Yields of Manured Plots compared with Controls.

Treatment.	Number of Paired Plots.	Grade.	Yield in Tons per Acre.			Odds.
			Treatment.	Control.	Difference in Favour of Treatment.	
(1.) Super ..	6	**Total**	12·74	8·67	4·07	4,999
		Table	6·64	4·11	2·53	2,499
		Seed	4·01	3·21	0·80	1,249
		Small	2·09	1·35	0·74	..
(3.) Super plus bonedust	6	**Total**	11·52	8·67	2·85	2,499
		Table	5·76	4·11	1·65	4,999
		Seed	3·95	3·21	0·74	243
		Small	1·81	1·35	0·46	..
(4.) Super plus bonedust and potash	6	**Total**	10·92	8·59	2·33	1,666
		Table	5·64	4·40	1·24	587
		Seed	3·56	3·02	0·54	768
		Small	1·72	1·17	0·55	..
(6.) Super plus bonedust, potash, and sulphate of ammonia	6	**Total**	13·38	8·59	4·79	4,999
		Table	7·66	4·40	3·26	1,428
		Seed	3·90	3·02	0·88	768
		Small	1·82	1·17	0·65	..

NOTE: Comparison of yields of small potatoes not treated statistically.

COMMENTS ON TABLE I.

(1.) Super *versus* control: The application of 3 cwt. of super has resulted in a total increase of approximately 4 tons per acre, 2½ tons of which are table potatoes and almost 1 ton seed, the remainder being small. The phosphate has caused an increase in the percentage of table potatoes, with a decrease in the percentage of seed. Allowing £3 and 30s. as the net value per ton of the increased portion of table and seed respectively, and deducting the cost of manure (super, 42/44, £7 5s. per ton; steamed bonedust, £12 10s.; sulphate of potash, £19; sulphate of ammonia, £22) per acre, the increase in monetary return due to the use of manure is £7 14s. per acre.

(3.) Super and bonedust *versus* control: Here again the yield is considerable, but results in a monetary increase of only £4 11s. 6d. per acre.

(4.) Super, bonedust, and potash *versus* control: The fertilizer mixture in this case is more expensive, and the net value of the increase of 1¼ tons of table and ½ ton of seed is considerably lessened, being only £2 7s. The percentages of table are the same in both cases, but the increase in the percentage of small on the manured plots is an

undesirable feature, and must be attributed to the effect of potash, as no such effects occurred when mixed phosphates only were used.

(6.) Super, bonedust, potash, and sulphate of ammonia *versus* control: The complete mixture of artificials, although the most expensive of the treatments, yields an increase the net value of which is £8 2s. per acre.

Table 2.—Series B and D, Manures top-dressed: Yields of Manured Plots compared with Controls.

Treatment.	Number of Paired Plots.	Grade.	Yield in Tons per Acre.			Odds.
			Treatment.	Control.	Difference in Favour of Treatment.	
(1.) Super ..	6	**Total**	11·67	9·15	2·52	832
		Table	6·86	4·99	1·87	302
		Seed	3·23	2·83	0·40	51
		Small	1·58	1·33	0·25	..
(3.) Super plus bonedust	6	**Total**	11·16	9·15	2·01	4,999
		Table	5·96	4·99	0·97	76
		Seed	3·63	2·83	0·80	999
		Small	1·57	1·33	0·24	..
(4.) Super plus bonedust and potash	6	**Total**	10·93	8·37	2·56	9,999
		Table	6·82	4·24	2·58	4,999
		Seed	3·05	2·96	0·09	2·8
		Small	1·06	1·17	0·11	..
(6.) Super plus bonedust, potash, and sulphate of ammonia	6	**Total**	10·80	8·37	2·43	1,249
		Table	6·69	4·24	2·45	9,999
		Seed	3·06	2·96	0·10	2·8
		Small	1·05	1·17	0·12	..

NOTE: Comparison of yields of small potatoes not treated statistically.

COMMENTS ON TABLE 2.

(1.) Super *versus* control: The super increase of 1·87 tons of table and 0·4 tons of seed gives a profit of £5 2s. 6d.

(3.) Super and bonedust *versus* control: The manure here shows a profit of £2 12s. 6d. per acre.

(4.) Super, bonedust, and potash *versus* control: The remarkable feature of this comparison is that the increase in the yield of table potatoes is equal to the total increase, and the percentage of increase is nearly 12. The decrease in the percentage of seed and small is highly significant. This result must be attributed to the potash when applied as a top-dressing some time after the potatoes are sown, and is totally different from the result of the application of potash with the seed. The net profit is £5 13s. 6d. per acre.

(6.) Super, bonedust, potash, and sulphate of ammonia: The complete mixture has behaved in an almost similar way, and the direct comparison of the fertilizers points to the value of potash when top-dressed. The sulphate of ammonia applied in this way appears to have a totally different effect from that got by application with the seed. The profit of this mixture is £4 9s. 6d. per acre.

COMMENTS ON MANURES COMPARED WITH ONE ANOTHER.

Manure with Seed.

Super *versus* super and bonedust: The superiority of super over the mixed phosphates is highly significant, the table potatoes alone being nearly 1 ton per acre better.

Mixed phosphates and potash *versus* mixed phosphates: The addition of potash to mixed phosphates has caused a depression in yield of 0·6 ton. Attention is here drawn to the fact that potash is often found to have a depressing effect on yield.

Mixed phosphates, potash, and sulphate of ammonia: This treatment showed a total increase of 2·19 tons per acre over potash and mixed phosphates. This very considerable increase is undoubtedly due to the sulphate of ammonia, and since this costs only 16s. 6d. per acre the result is highly paying.

Manure top-dressed.

Super *versus* super and bonedust: There is no difference between yields of these treatments, though the former shows a slightly lower percentage of small potatoes.

Mixed phosphates and potash *versus* mixed phosphates: Although there is no marked difference in the total yield, the potash has had a very marked effect on the table grade, increasing the yield by nearly 1 ton per acre. The reduction in the amount of smaller kinds is considerable, and this behaviour of potash when used as a top-dressing is important. The increase in yield of "tables" gives ample justification for its application in this way. The work of the present season is designed to further test the behaviour of potash under the different methods of application.

Mixed phosphates and potash *versus* complete mixture: It would appear that sulphate of ammonia when applied as a top-dressing is of little use. This should be compared with the effect of sulphate of ammonia when applied with the seed.

Referring to potatoes, Sir E. J. Russell states in the *Journal of the Ministry of Agriculture* (England), 1925, page 405: "The effect of the nitrogenous dressing depends on the time of application. In all our experiments it has proved better to apply the sulphate of ammonia with the seed rather than to give it later as a top-dressing when the plants are showing through the ground."

(To be continued.)

New Rabbit Districts.—The constituting of the Whangamomona Rabbit District for the purposes of Part III of the Rabbit Nuisance Act, and of the Wanganui Rabbit District under Part II of the Act, were gazetted on 4th March.

A cow producing 300 lb. of butterfat consumes about 20 tons of grass during the year. Adequate feeding at all periods of the year is essential to secure economical production. If grass fails, special crops must be provided.

LIMING AND TOP-DRESSING EXPERIMENTS IN MARLBOROUGH.

OBSERVATIONS FOR 1925-26 SEASON.

(Concluded.)

F. W. GREENWOOD, B.A., Instructor in Agriculture, Blenheim.

THE KOROMIKO AREA.

THE pasture laid down at Koromiko in the autumn of 1924 was of quite a different nature from that existing at the Spring Creek area. On the flat country of the Sounds district far too little is done in the direction of establishing permanent pastures of English grasses and maintaining such pastures by a correct system of top-dressing with artificial fertilizers. For two reasons it is undesirable to hay such pastures: (1) Because cutting tends to weaken the natural growth of the pasture elements, and (2) because such grasses as cocksfoot and timothy, while excellent grasses in the pasture sward, make much poorer hay than does red clover.

For the purpose, however, of making comparisons in the first two seasons, weighings have been taken from all these plots. It is our intention, however, for the future not to hay the paddock, but simply to stock it and spell it from time to time as the exigencies of farm-management demand. In the early spring of the current year the pasture will be shut up and an analysis of its constituents made; a farmers' field-day will be held, differences noted and photographed, and then the pasture will be stocked again.

As recorded in the account of the preceding season's operations published in the *Journal* for September, 1925, the pasture mixture sown at Koromiko was as follows: 12 lb. cocksfoot, 15 lb. perennial rye-grass, 4 lb. Italian rye-grass, 3 lb. timothy, 4 lb. crested dogstail, 2 lb. white clover, 2 lb. cow-grass; total, 42 lb. per acre. Although the hay cut in the spring of 1924 consisted almost entirely of temporary elements—Italian and perennial rye-grass—the pasture at hay-making-time in 1925 presented a good showing of cocksfoot, timothy, crested dogstail, and red and white clover. The growth of these elements, although now good, was poor until the second season.

The plots were divided into three series: (1) A trial of lime against no lime; (2) a trial of 2 cwt. of superphosphate applied annually, together with 1 ton of carbonate of lime per acre applied periodically (only one dressing so far applied), against 1 ton of lime carbonate per acre alone; (3) a trial of an annual top-dressing of 2 cwt. of super against an annual top-dressing of 2 cwt. of blood-and-bone per acre.

The following table will enable a comparison to be instituted between the two seasons' weights (sixteen to twenty weighings taken from each method of treatment):—

If control plots are represented by the number 100, then—

1924–25 Season.		1925–26 Season.	
Average of limed plots ..	111	Average of limed plots ..	102
Average of super alone ..	113	Average of super alone ..	130
Average of super and lime ..	131	Average of super and lime ..	149
Average of blood-and-bone ..	113	Average of blood-and-bone ..	117

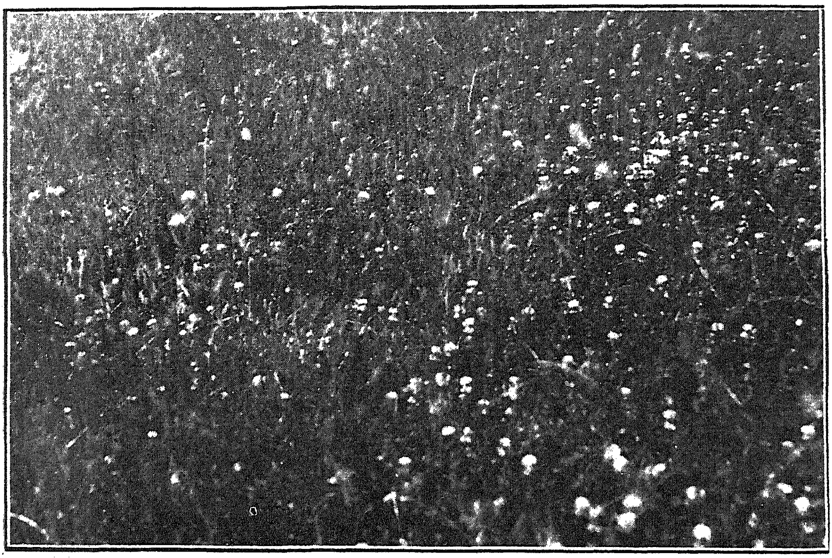


FIG. 1. A NEAR VIEW ON THE KOROMIKO PLOTS.

On left, lime alone; on right, lime and superphosphate.

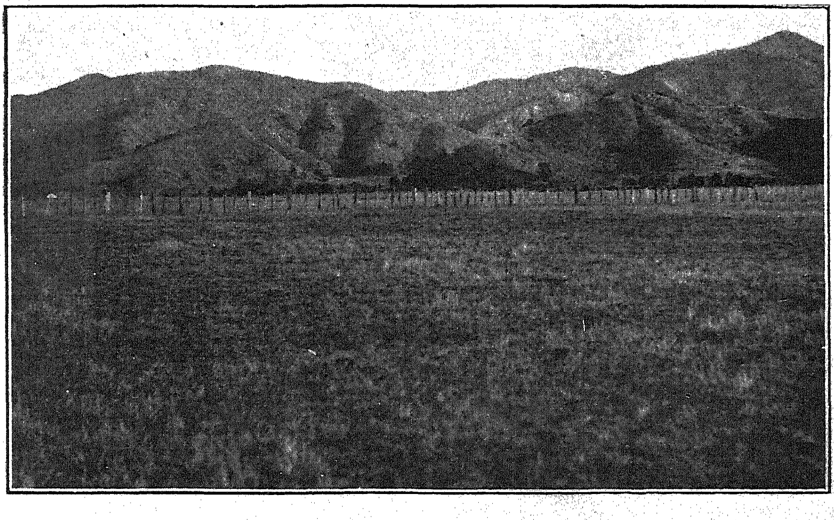


FIG. 2. GENERAL VIEW ON THE PLOTS AFTER STOCKING.

The dark patches are limed and manured areas closely grazed by the stock; the light parts are untreated control plots where the grass stubble has been left by the stock.

Although the weights do not bear testimony to any beneficial effect from the use of lime alone, at the time the hay-cut was made there was a strong difference in colouring, the limed plots being of a much darker green. The difference between the plots treated with super and lime and those treated with super alone was marked, the clover bottom in the case of the former being much thicker. The weights also show a perceptible superiority over those obtained from the plots treated with super alone. Blood-and-bone, although on the average giving the lowest return of any manure applied, shows a superiority over the untreated plot yield. One must take into consideration, however, that while the cost of the blood-and-bone was 12s. per hundredweight the cost of the superphosphate was 6s. 4½d.

The first accompanying photograph (Fig. 1) shows the difference between the results obtained on the plot treated with super and lime as compared with that treated with lime alone. The second (Fig. 2) was taken after the paddock had been stocked, and shows how the cattle and sheep have left the long grass stubble uneaten on the control plots, but have grazed close to the ground the pasture on the plots treated with lime or manure.

If lime were applied on the Koromiko flat country once in four years the cost would be about 6s. 3d. per annum exclusive of labour. The costs might therefore be compared somewhat as follows: Lime alone, 6s. 3d. per annum; 2 cwt. super alone, 12s. 9d.; 2 cwt. super and lime (once in four years) at 1 ton per acre, 19s.; 2 cwt. blood-and-bone, 24s.

It will thus be seen that super and lime, taking the evidence of weights and costs alone, is less payable than super alone. However, there is considerable reason to think that when a pasture analysis is made this decision will be reversed, as the clover content on the plots treated with super alone is much weaker than that on the plots treated with super and lime.

SALT POISONING IN PIGS.

A RECENT mortality resulting in the deaths of nine pigs in Taranaki, investigated by the Live-stock Division and found due to excess of salt entering the feed, points to the necessity of warning pig-breeders of the extreme susceptibility of the pig to the action of salt. The pigs in question were whey-fed. A specimen of the whey was analysed by the Department's Chemist and found to contain salt to the extent of 2·56 oz. per gallon.

The symptoms shown by pigs affected by ingestion of excess of salt come on suddenly and indicate disturbance of the nervous system. The animals show loss of co-ordination in movement, staggering about, and frequently falling over on the side and struggling. There is also apparent blindness. Eventually complete loss of power occurs in the hind legs, followed by death. *Post mortem* examination reveals inflammation of the lining membrane of the stomach and intestines.

Treatment of affected pigs is practically hopeless. In prevention of the trouble care must be taken to exclude from the swill anything which is likely to contain salt in excessive quantity.

—*Live-stock Division.*

TESTING OF PUREBRED DAIRY COWS.

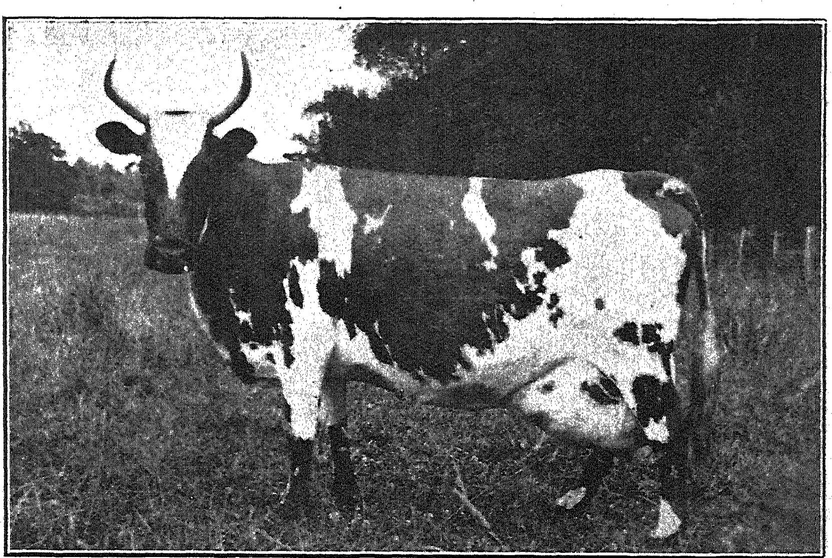
JANUARY TO MARCH C.O.R. LIST.

W. M. SINGLETON, Director of the Dairy Division.

COMMENCING the records for the new calendar year, 1926, fifty-one cows have been issued certificates in the three months January to March, details being given in the appended list.

The highest performance in the Jersey section is that of Mr. S. Dale's Remarkable Mary, a three-year-old, which has gained a certificate on 742·05 lb. butterfat. This animal already has one C.O.R. to her credit—577·18 lb. in the senior two-year-old class. Remarkable Mary was bred by her present owner, Mr. S. Dale, of Fairlie. Her sire is Remarkable of Meadowbrook, who is in turn sired by Lord Twylish, one of the best-known sires of the breed in New Zealand. On the dam's side Remarkable Mary traces back to K.C.B., Campanile's Sultan, and Starlight, each of which has figured more or less prominently in the building of the breed in New Zealand.

The most remarkable performance among the Friesians here recorded is that of Mr. J. McAnulty's Lady Rosebud, with 794·40 lb. butterfat, in the mature class. This cow was bred by Mr. J. Boag, jun., Brookside, Canterbury. She is the only tested daughter of De Kol's Duke, who is a son of Commodore de Kol, with three 600 lb. C.O.R. daughters to his credit. Commodore de Kol is by Nazli de Kol (ten C.O.R. daughters), who, in turn, is by Sir de Kol Inka



DEWDROP 1ST OF BROOKSIDE (W. HALL, LEPPERTON).

C.O.R., 1926, in Ayrshire mature class: 9,565 lb. milk, 385·98 lb. butterfat. This worthy representative of the breed is upwards of fifteen years old.

Pietertje (sixteen C.O.R. daughters). The dam of Lady Rosebud is Rosebud 2nd of Kokatau, whose dam, Rosebud of Kokatau, has a C.O.R. for 407·77 lb. butterfat. Lady Rosebud traces back to Edinglassie (seven C.O.R. daughters).

An interesting performance recorded is that of Mr. W. Hall's Ayrshire cow Dewdrop 1st of Brookside. The record is noteworthy on account of the age — 15 years 109 days — at which this cow commenced her test. The accompanying photograph is a recent one, and would seem to suggest that Dewdrop is good for several years yet. The constitution which has enabled her to keep going so long is quite apparent, and it is also evident that she is the type of a producer. Dewdrop 1st of Brookside has won many show-ring championships. She has produced some fourteen calves, so that her combination of powers of production and reproduction should make her a valuable foundation cow of the breed.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Queen's Glaxo Lass ..	H. J. Burrell, Bunnythorpe	2 28	243·3	365	8,611·2	521·33
Tirohia Grandiflora ..	B. E. Veale, Tirohia ..	2 53	245·8	364	8,834·25	441·17
Alfalfa Mademoiselle*	J. R. Kelly, Morrinsville ..	2 45	245·0	354	8,211·3	434·43
Magnet's Neat Maiden	H. Doel, Taumarere ..	1 206	240·5	365	7,399·3	410·64
Competitor.. ..	F. J. B. Ryburn, Paterangi	2 84	248·9	365	6,348·6	395·21
Beaumont Crystal ..	C. J. Masters, Hunterville	1 298	240·5	364	6,842·4	345·43
Tillingdown Rilette ..	H. O. Washbourn, Richmond	1 338	240·5	365	7,183·4	343·45
Joybank Pride ..	Mrs. A. Henry, Omata ..	2 30	243·5	365	6,643·8	341·64
War Bride of Puketapu	T. H. Western, Bell Block..	1 352	240·5	219	4,809·9	293·85
Holly Oak Rita ..	T. H. Western, Bell Block..	1 359	240·5	365	4,956·6	289·18
Woodlands May ..	T. H. Verry, Pahiatua ..	1 336	240·5	251	4,905·5	253·29
Senior Two-year-old.						
Swan's Fox's Fancy..	Brakenridge and Pearson, Taupaki	2 145	255·0	365	8,985·6	494·06
Creamlands Darkie ..	T. H. Verry, Pahiatua ..	2 100	250·5	262	5,172·9	275·75
Three-year-old.						
Remarkable Mary ..	S. Dale, Fairlie	3 211	298·1	365	11,450·2	412·05
Milly Merit.. ..	F. S. Veale, Cambridge ..	3 42	281·2	365	6,692·8	[illegible]66·04
Four-year-old.						
Ohio Abbess* ..	W. T. Williams, Pukehou ..	4 113	324·8	365	12,144·7	709·41
Maiden's Neatness ..	W. McKenzie, Palmerston N.	4 75	321·0	365	7,891·9	548·72
Mature.						
Waipiko Chloris ..	S. H. Wearing, Richmond	7 70	350·0	361	12,759·0	643·82
Jerseydale's Princess May	J. Pettigrew, Pihama ..	7 26	350·0	365	11,856·6	598·02
Waipiko Morelle ..	R. Waterhouse, Papakura	8 147	350·0	365	8,583·0	556·52
Una's Choice ..	J. B. Clemow, Stratford ..	7 137	350·0	365	9,096·6	543·25
Almadale Pride ..	J. K. Watson, Tatuanui ..	6 189	350·0	365	9,683·2	533·30
Moth of O.K. ..	F. V. Green, Midhirst ..	7 138	350·0	279	7,510·6	411·41
Ivondale Sunshine ..	P. J. Petersen, Brixton ..	6 98	350·0	187	7,454·1	353·89

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
	FRIESIANS.	Yrs.	dys.	lb.		lb.	lb.
Junior Two-year-old.							
Johanna Pontiac Valdessa*	John Court (Ltd.), Auckland	2	16	242·1	365	17,919·7	635·70
Rosevale Jessica Posch*	H. North and Sons, Omimi	2	47	245·2	365	17,807·0	545·29
Fairmont Lady Grace*	James Hart, Tatuanui ..	2	70	247·5	365	15,289·6	506·07
Rosevale Gipsy Abbekerk Posch*	H. North and Sons, Omimi	2	103	250·8	365	15,409·1	489·25
Bainfield Topsy Bell*	Piri Land Coy., Auckland ..	2	74	247·9	365	13,303·2	420·08
Longbeach Transvaal Princess 2nd†	J. H. Grigg, Longbeach ..	2	102	250·7	301	9,436·8	338·78
Nanette Ormsby ..	W. Barton, Featherston ..	1	333	240·5	306	8,473·5	292·88
Lady Fern Cliff Pontiac Valdessa †	John Court (Ltd.), Auckland	2	10	241·5	337	7,775·3	284·65
Anawhata Dorothy Belle Segis	P. F. Boucher, Kumeu ..	2	4	240·9	349	7,613·1	277·30
Countess Johanna Valdessa Fayne†	John Court (Ltd.), Auckland	2	2	240·7	322	6,911·3	255·75
Junior Three-year-old.							
Cluny Nazli Buttercup*	Piri Land Coy., Auckland ..	3	39	280·9	365	15,360·3	520·81
Junior Four-year-old.							
Glencairn Rose Bud	W. H. Staniland, Clandeboye	4	85	322·0	347	10,556·8	452·99
Mature.							
Lady Rosebud* ..	J. McAnulty, Ashburton ..	9	108	350·0	365	17,017·0	794·40
Rosevale Bertha Posch*	H. North and Sons, Omimi	6	82	350·0	365	18,561·5	610·23
Lady Bountiful Domino*	F. G. Wayne, Parawai ..	7	142	350·0	365	15,253·6	527·73
Wakalona's Jewel ..	Mrs. A. M. Budd, Carterton	9	299	350·0	331	11,437·8	461·38
Ashlea Coral* ..	R. Colee, Greendale ..	6	28	350·0	292	14,938·9	459·35
Topsy Queen Pontiac†	John Court (Ltd.), Auckland	7	37	350·0	365	11,227·2	411·51
Countess Belle Segis†	Waitemata Stud Farm, Hobsonville	6	10	350·0	365	10,630·6	356·64
	AYRSHIRES.						
Four-year-old.							
Duchess of Ivanhoe ..	A. M. Weir, Menzie's Ferry	4	288	342·3	364	11,714·6	431·19
Mature.							
Dewdrop 1st of Brookside	W. Hall, Lepperton ..	15	109	350·0	365	9,565·5	385·98

Second-class Certificates.

	Jerseys.						
Junior Two-year-old.							
Fauns Free.. ..	B. N. and W. A. Sandilands, Feilding	1	325	240·5	365	7,251·1	368·82
Mature.							
Belvedere Maiden's Pride	R. R. Dean, Te Kumi ..	9	29	350·0	365	11,210·2	581·39
	Friesians.						
Junior Two-year-old.							
Hobson Princess Fayne Segis	John Court (Ltd.), Auckland	2	13	241·8	365	16,967·0	583·99
Star Queen.. ..	J. McAnulty, Ashburton ..	1	357	240·5	365	16,938·7	519·83
Westmere Princess ..	Piri Land Coy., Auckland ..	2	58	246·3	365	12,347·1	401·77
	Milking Shorthorns.						
Mature.							
Dominion Gentle of Ruakura	W. H. Simms and Sons (Ltd.), Christchurch	5	364	350·0	365	12,055·5	489·30

SEASONAL NOTES.

THE FARM.

WHEAT-GROWING IN CANTERBURY.

It is now becoming generally recognized that wheat is an important crop in the best rotations for the stronger Canterbury soils. Were it not for wheat-growing much short-rotation grassland which is now broken up and brought into profit by growing rape and young grass would be left for years as unproductive, patchy, and run-out lea. Once land is worked up, a succession of crops can be taken with comparatively little cost of cultivation, and the wheat crop helps to pay for the putting-in of the plough.

Place in rotation : Wheat after peas, oats and tares, or clover is the ideal, but wheat following rape is good practice, especially where the rape crop follows lea. The roots of the rape will disintegrate the turf at the bottom of the furrow, and, the soil being further enriched by droppings, the conditions are ideal for the wheat-plant. Last year saw many profitable wheat crops sown late on the potato lands; but late sowings are very uncertain, as the rooting-system is not sufficiently developed to enable the plant to withstand drought. Wheat after wheat or oats pays, because the second crop can be obtained with a minimum of cultivation; but even on strong soils the number of wheat crops that can be taken in succession is very limited, and a second crop should be well supplied with manure. Wheat grown after lea is generally rather subject to grass-grub attack, and it is the best principle to take a preliminary rape crop. If, however, wheat is to be grown, the lea should be skimmed early and the skimming worked down. If the grass is wanted till late on in the season a good quick substitute for skimming is to thoroughly tear up the turf with the disks and cultivate before ploughing. This turning to the bottom of 2 in. or 3 in. of well-worked soil ensures that the furrow is worked to its full depth; the plants' roots thus have a widened range, and, more important still, there is a good connection with the subsoil reserves of moisture.

Manuring : In spite of the fact that phosphate manuring pays with certainty on most Canterbury soils, the neglect to apply such fertilizers is all too common. An amount of 1 cwt. per acre of superphosphate or basic super sown with the seed gives the plant a good start, and increases the rooting-system during the early part of its life, so that it is able to grow satisfactorily in the drier months preceding harvest. Nitrate of soda at 1 cwt. per acre, top-dressed in the spring, should pay with wheat after wheat, especially if a wet winter has caused leaching of nitrates from the soil. The Department of Agriculture is conducting trials along these lines, and reliable information will be given at a later date.

Seed : Machine-dressing of wheat is a paying proposition, for not only is the part taken out valuable as fowl-wheat, but sowing broken grains is absolute waste. Many of the small shrivelled seeds sown

are harmful in that they produce weakly plants, which rob their more robust neighbours yet never come to maturity. Plants produced from large plump grains are less likely to be attacked by fungoid diseases. Finally, weed-seeds are removed by screening.

Sowing: Sowings should take into consideration the size of grain, tillering-power, and amount of damage done by pickling. In the light of these considerations reasonable sowings on well-prepared land would be 65 lb. Velvet or Pearl, 76 lb. Hunter's, and 86 lb. Tuscans, increased to 90-100 lb. for August sowing.

Pickling: Wheat-smut can be controlled by pickling, and this practice should always be followed unless seed can be obtained from a crop guaranteed clean. Steeping the wheat overnight in half-sackfuls for seven minutes in diluted formalin solution—1 pint commercial formalin to 40 gallons water—has proved effective. Dusting with copper carbonate is increasing in favour in other countries, and the Department is making further and extended trials of this method during the present year.

Feeding off: On good wheat-land, where the spring growth is vigorous and early, feeding off increases the tillering and improves the yield. The best tillering variety is probably Hunter's, but Velvet, Pearl, and, to a less degree, Tuscan also benefit. A crop should never be fed off if there is likely to be a shortage of moisture later, and it should be fed off early to avoid eating-out of the flowering-stalk. A big mob of sheep should be used, and then the ground harrowed well to break the crust and break down the surface clods.

It may be mentioned that the foregoing notes apply also in general to North Otago conditions.

TOP-DRESSING OF PASTURES.

It is now realized by all up-to-date farmers, particularly in dairying and lamb-fattening districts, that top-dressing is one of the most important functions on the farm. In districts where the roads are likely to get out of repair early, supplies should be got on hand so that the work may be pushed along as time permits. There is quite a wide range of time as to when the fertilizers may be applied, but the following is suggested as a rough calendar for average districts: April to May—Nauru and other Island phosphates, Ephos phosphate, and bonemeal; May to July—basic slag, basic super, and mixtures of super and Nauru phosphate; July to September—super. Proprietary mixtures, as a rule, are best applied from May to July, but, as already mentioned, there is ample latitude.

The question as to what is the best fertilizer depends on local and other considerations, but in a general way the main thing is to use a good phosphatic manure. The best of these are basic slag, basic super, super, and mixtures of super and Nauru phosphate or super and bone. Where there is a rainfall of 40 in. or over any of the mixtures should give good results, but for preference probably basic super, basic slag, mixtures of half super and half Nauru, or super by itself. If the land has been previously limed, or it is the intention to lime, super may be used with confidence, but if no liming has been done or proposed it is a sounder practice to use a manure containing lime, such as basic super or basic slag. Very good results are obtained from the use of super,

provided there is sufficient lime available in the soil. If, however, super is top-dressed indefinitely a time comes when all the available lime is used up, and when this happens the results tend to be poor; hence the advisability of keeping up the lime-supply.

The quantity of fertilizers to apply per acre depends greatly on the condition of the pasture. If it is in first-class condition, from 1½ cwt. to 2½ cwt. per acre is ample. If, on the other hand, no previous manuring has been done and the pasture is getting weak, heavier dressings are necessary, and from 3 cwt. to 4 cwt. should be applied; after the first dressing subsequent applications may be reduced. In top-dressing, the aim should be to apply a fertilizer that will give good results the year following the application, rather than to use so-called lasting manures that may give a result in a year or two. The practice of medium dressings at frequent intervals, in preference to heavy dressings at long intervals, is recommended generally.

Where the land is reasonably level and free from stumps it is a good practice to harrow the pasture both before and after top-dressing.

GENERAL TILLAGE OPERATIONS.

Grassland intended to be broken up for spring crops, especially mangolds, carrots, millet, and maize should be skim-ploughed. Some of the heavy soils benefit greatly from a winter fallow; on the other hand, much of the lighter land leaches considerably, and is better sown in a green catch-crop of some sort. The climatic factor counts largely in this matter.

Those who intend growing mangolds for next season should select a suitable area and make early preparations. About 1 acre for every twenty cows is generally sufficient. Selection should be made of the cleanest field on the farm, with, if possible, a soil consisting of a deep friable loam or clay. Though normally the mangold gets through dry spells very well, it is safer and better practice to prepare for the crop early.

In the frostless belts where early potatoes are grown it is a common practice to sow in May. The ground should be well worked. An application of some 6 cwt. to manure consisting approximately of 4 cwt. superphosphate, 1½ cwt. sulphate of potash, and ½ cwt. sulphate of ammonia per acre should be found suitable in general.

Root-bound paspalum pastures can be renovated by ploughing now in narrow furrows about 4 in. to 5 in. deep. The ploughing is left during the winter, and the paspalum comes away between the furrows. In the spring the land is disked and harrowed, and a sowing of rye-grass and clovers, including subterranean clover, is made, together with a top-dressing of 2 cwt. to 3 cwt. of fertilizer per acre.

THE ROOT CROPS.

Feeding of the swede crop may be commenced in the coming month as required, more especially if disease is showing. Dairy-farmers using swedes should endeavour to pull and feed the roots daily on clean pasture, with a reasonable ration of hay, thereby saving

waste, while at the same time closely controlling the quantity of roots fed. Milk taint can thus be the better prevented and redwater more easily avoided.

Mangolds should be pulled during May, and stored in clamps for late feeding. For lifting mangolds the usual method on small areas is to work between two rows, pulling alternately with each hand; by a sudden jerk the tops are removed, and the roots dropped in rows handy for loading. Where larger areas have to be dealt with a couple of planks fixed on edge in the shape of a V and pulled by a horse from the apex will push the roots out of the ground into rows, but in this case the tops should be fed off previously with a mob of old ewes. Provided the weather is not too frosty, the roots should be left lying in the field for two or three weeks to ripen off. The real danger from frost is the effect on the part of the root which was underground, and which is very tender. Mangolds are excellent milk-producers for both dairy cows and ewes, but must be fed carefully in small quantities at the beginning, and with a fair allowance of hay. In the case of feeding off with sheep it is usual, provided the crop is a globe variety, to harrow out each break a few weeks ahead of feeding.

Carrots are best left in the ground and pulled for feeding as required.

It is a good plan to feed roots and hay on patches where the grass-grub has been at work, or on other poorer spots, and thus encourage consolidation of the soil and the trampling-in of seeds dropped from the hay.

MISCELLANEOUS.

Where ensilage is provided for dairy cows it should be fed in moderate quantities fresh daily in the field, and should never come into contact about milking-sheds, owing to the danger of tainting milk.

Small calf-paddocks should be broken up periodically and regrassed. Failing this they may now be eaten bare with big cattle, then top-dressed with about 10 cwt. of burnt lime per acre, following in August with 2 cwt. of superphosphate per acre.

Having regard to the prevalence of Californian thistle, it is good practice generally in the South to sow oats in autumn. The crop will then ripen before there is any danger of the thistle-seeds maturing. On the other hand, spring-sown oats, which do not ripen for a month or six weeks later, are frequently infested with mature thistle-seed, and this is one of the chief means by which the pest is spread.

Clover-seed and lucerne-seed in stack should be allowed to come out of the sweat before shelling is commenced. Fitness of the seed may easily be tested by driving a crowbar into the side of the stack, leaving it there for twelve hours, then taking it out to see whether the end inserted into the stack is warm or damp.

If feed is running short, pigs may be put on the artichoke crop in April, giving a fairly large break to avoid puddling during wet weather. Or stocking may be deferred for a couple of months if other feed is available.

The outlets of all drains should be attended to and put in good running-order before winter sets in. It is a good thing for every farmer to have a sketch-plan of his farm, showing each field and where watercourses and drains are situated. —*Fields Division.*

THE ORCHARD.

THE AUTUMN CLEARING-UP.

WITH a number of growers the beginning of May will see the fruit harvest gathered and disposed of, and time will then permit of a general clearing-up preparatory to commencing the winter work.

Following a dry summer, one should be prepared for a wet autumn and winter, and it will be well to give consideration to the matter of drainage. Existing drains will probably require cleaning out, and it is a good policy to divert surface water into these by the most direct route so as to save loss of soil.

The time will also be opportune for searching out and destroying trees badly affected by such diseases as silver-blight, and removing limbs similarly affected in otherwise healthy trees. Unless this is done while the foliage is still on it is not possible to distinguish the affected branches, and the trouble is carried over to the spring again.

During the rush of the season the mummified remains of peaches, plums, &c., affected with brown-rot are often left on the ground. These should now be gathered up and deeply buried or otherwise destroyed.

STONE-FRUIT TREES.

At this time, though it may not be desirable to commence winter pruning, much good may be accomplished by removing the surplus growths inside overvigorous and congested stone-fruit trees, so as to enable the buds to ripen up and the wood to harden for next season's crop. After this the trees may be sprayed with 6-4-40 bordeaux for the prevention and eradication of brown-rot spores, rust, and other fungi common to stone-fruits.

PLOUGHING.

In localities where green crops have not been sown the land can be turned up for the winter, taking care to do this in such a way that the water will be diverted from the trees. On heavy soils the turning-over of the land is beneficial at this stage, as the winter frosts will help to break up the areas that have become packed through the constant carting with the spray - pump and fruit - carts. Areas intended for orchard-extension should also be deeply ploughed now in readiness for working down and planting in the spring-time.

NEW PLANTINGS.

Decision should now be made as to what varieties are needed, and orders given at once so as to obtain the best trees. Those who order last when stocks are running low usually get the worst bargain. In some localities and good friable soils planting can be done to advantage in the autumn. —*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

If the land has not yet been put in order for the winter this should be done at once, leaving the soil in a rough state where green crops are not being grown, but well worked down otherwise. In all cases the plot should be so graded as to provide an easy run-off for surplus moisture. Generally the best way to do this is to leave an open furrow in the middle of each land inclining with the fall of the plot.

Some pruning may be done at this season; indeed, it is essential that all branches which are likely to touch the ground should be removed prior to the wet season, if the spread of lemon brown-rot is to be prevented. Throughout the trees will also be found many long summer growths. These should be cut back to about half-length in order to induce fruiting lateral growth, and any which are in excess should be cut clean out, as also should the very perpendicular type of growth, particularly from the inside of the tree. Keep a lookout for limbs or branches which cross each other, and cut sufficiently clear to prevent rubbing. Much damage is caused by this kind of bark-injury during rough winter weather, which timely pruning would have prevented.

Sites on which it is proposed to plant citrus-trees during the coming planting season should be prepared now. The first essential is good drainage; and if this is not natural, artificial drains should be put in at intervals suitable to drain the type of soil. A thorough cultivation of the land—ploughing and subsoiling—should be carried out; time spent in levelling up irregularities of the surface will be well repaid in after-years. —*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

WINTER EGG PRODUCTION.

THE season is now at hand when maximum prices rule for strictly fresh eggs. As the great bulk of the adult birds will be resting and undergoing the moulting process, the pullets must be chiefly relied upon to produce these eggs. Thus the chief concern of the poultry-keeper at the present time should be to give the pullets the best possible attention in order that they may produce to their maximum capacity.

The poultry-keeper who succeeds in obtaining a high winter production leaves nothing to chance; he realizes that such eggs are an out-of-season and artificially stimulated product. In the spring and summer months, when the hen lays naturally, it is a simple matter to secure a good egg-yield, but even with the bird bred to lay in winter it is entirely different. The slightest error made in managing the pullets when commencing to lay is not only apt to cause a false moult, but in addition to give the birds a setback that is not recovered for weeks, and sometimes months. In short, everything should be done to provide conditions resembling those that prevail in spring and summer—in other words, the natural laying season.

In the first place, the house should be roomy—not merely enough for the birds to roost in by night, but sufficiently large to accommodate

and to provide exercise in comfort for all the birds when unfavourable weather conditions prevail. It is of the first importance that the birds be fed under cover at all times, and not compelled to wait about in the yard for feeding-time on cold and wet days. Exercise is another important matter which must not be overlooked. The value of exercise as a means of promoting winter laying is not so generally realized as it should be. To induce exercise the floor of the house should be thickly littered with straw, and the dry grains of the evening meal scattered therein. Sufficient grain should be given so that some is left over for the birds to scratch for in the early morning.

Hand-in-hand with good housing and comfortable conditions should go regular and liberal feeding. There is no greater mistake made than the idea that the heavy layer when fed on the right class of food can be overfed and become too fat to lay. Another important point is not to subject the laying pullets to frequent changes of food. The more uniform the treatment they receive in all respects the less risk will there be of their going into a premature moult.

Only the best grain materials available should be used. At the present price of eggs it will pay to feed the best foods irrespective of cost, within reason. In this connection poultry-keepers should beware of some of the so-called pollard that is on the market. Some of the samples which have recently come under my notice would be next to useless for promoting egg-production. Indeed, it is a rare thing to see good pollard in these days, even at its present extreme price, and it would appear that a substitute will have to be found to wholly or partly take its place. A good material for this purpose is finely ground wheat. One part of wheatmeal to two parts of bran is recommended, the proportions being varied according to the quality of the wheat. Unfortunately, as with pollard, much of the wheatmeal on the market is of a decidedly inferior quality, and where possible poultry-keepers are recommended to choose their own sample of wheat and get it ground specially.

The mash should be made as appetizing as possible by moistening it with meat soup, milk, or hot water. For the evening meal wheat, when available, should be looked upon as the stable grain. It is, however, a good plan to mix oats and maize with it. During cold weather the grain ration may consist of at least one-third maize, but in hot weather this should be given in a less quantity. The manner in which the birds appreciate the different kinds of grains must also be taken as a guide. When it is observed that they are leaving any particular grain, this should be given in reduced quantity. Of course, this only applies where all the grains are of good quality, as fowls dislike inferior or damaged grain.

In addition, the ration should include meat, or meat-meal, preferably fed by itself. These forcing-foods are specially demanded to ensure a good supply of eggs during the cold months of the year. Care must be taken, however, that such foods are not oversupplied, especially in the mash, or it will have the inevitable result of bringing on ovarian troubles, protrusion of the oviduct being a common phase.

Green food should be provided in abundance, and likewise the grain materials referred to. Grit is another essential to the well-being

of fowls of all ages, and should be always available for them to pick at. It should be remembered that fowls have no teeth with which to masticate their food, and that grit acts as a substitute. Proper digestion cannot take place unless the gizzard contains sharp gravel, grit, or similar material, and without good digestion a bird cannot maintain good health and a highly productive condition. In addition to grit, laying hens should have crushed oyster-shell or other fresh sea-shell always in reach to provide egg-shell-forming material. Burnt or charred bones, put through a grit mill, are also good for shell-making, and are much relished.

Finally, care should be taken that there are no cracks in the back or side walls of the house to let in cold draughts—a most common cause of colds and the forerunner of roup. The common symptoms of colds are sneezing, eyes watering, and a discharge from the nostrils, to which dirt and dust adhere. In severe cases the discharge will usually be found on the feathers under the wing, owing to the bird sleeping with its head thereunder. When any of these symptoms manifest themselves the first essential is to find the cause and remove it, for, as with most troubles affecting poultry, it is next to useless trying to cure the trouble if the cause is not first removed.

CULLING THE WRONG BIRDS.

In previous notes published in the *Journal* much advice has been given regarding the class of bird that should be culled from the flock, and the one that should be retained for profit-making. It has been pointed out over and over again that the late autumn is the best time for culling a flock, and that the heaviest layers are the thinnest at this period and present the most worn and shabby appearance, while the heaviest and best-looking birds are the drones. That many poultry-keepers are not familiar with the points indicating high or low egg-producing capacity is borne out by the large number of birds sent to market which are not only in a highly productive condition, but which also give striking indications of being the best future profit-makers. Obviously, in such cases the bird that has laid well in the past and is likely to in the future has been discarded, while the poor layer in the past and necessarily a drone in the future has been retained on the plant.

This common mistake of weeding out the wrong birds is undoubtedly due to their rough shabby appearance, and ignorance on the part of their owners in not knowing that the apparent worse-for-wear condition is solely due to heavy production. It is safe to say that thousands of pounds' worth of eggs are lost annually by poultry-keepers through lack of knowledge in culling their flocks to the best advantage. The worst feature is not so much the first loss in eggs, but rather the great deterioration that must ultimately follow by using the weak types remaining on the plant for future breeding purposes.

Poultry-keepers lacking in experience in culling and who are desirous of assistance are reminded that the services of the Department's Poultry Instructors are available free of cost for the purpose. Applications for assistance should be addressed to the Poultry Instructor, Department of Agriculture, at Auckland, Wellington, or Christchurch.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

MANAGEMENT OF SUPERS.

As advised previously, the removal of the supers should go on steadily while the bees form their winter clusters. In the case of very strong colonies it will often be found difficult, if not impossible, to confine the bees to one story without seriously diminishing winter stores and unduly crowding the bees. In these cases it is best to leave the supers on till the spring.

The best place for winter stores is in the hive, and however careful the beekeeper may be in replenishing these, if the honey is removed from the hives he still runs the risk of allowing the bees to starve if the honey is not within their reach at all times during the cold weather. There are very few districts in New Zealand where brood-rearing absolutely ceases during the winter, especially when the hives are well sheltered, as the bees require food at all times and seasons. On no account should they be allowed to winter in more than two stories. In many cases they will be showing a tendency just now to go as high as they can get in the hives, and where this happens it will usually be found that the combs in the bottom story are deserted and dry. A rapid examination will soon show the beekeeper whether this state of affairs obtains, and, if so, he should remove the bottom story, leaving the cluster undisturbed.

Where queen-excluders have been left on the hives they should be removed, because it sometimes happens that the bees will go through the excluders to the stores above, leaving the queen to perish below. There is always a tendency for the cluster to move to the warmer part of the hive, and an excluder will not act as a bar if the bees are dissatisfied with the lower story.

MATS FOR WINTERING.

To ensure that the bees are kept warm through the cold weather it is absolutely necessary that the frames should be well covered with good mats. Three or four are by no means too many to provide for each hive. Ordinary corn-sacks cut into pieces the size of a zinc queen-excluder answer the purpose admirably, and are very durable. Avoid using calico mats, as these are next to useless for wintering purposes. It is essential that the mats should fit exactly over the frames ; if too small they admit draughts, and if too large the edges will protrude beyond the hive-covers, and in wet weather these will absorb sufficient water to cause the mats to become damp and unhealthy and the combs mouldy.

CLEARING WEEDS.

Weeds should be kept down in the apiary. A good clearing round the hives in autumn will suffice until spring, and will add materially to the comfort of the bees and the well-being of the hives during the winter months. Not only should the extrances be cleared, but the ground all round the hives should be similarly treated, and the weeds raked up and destroyed.

UNITING COLONIES.

The presence of weak hives in the apiary must be avoided as far as possible. During the warm autumn days these colonies rarely escape the attention of robber-bees, and are easily molested. When once they are attacked the beekeeper will find it extremely difficult to save them, and eventually they will get robbed out despite his efforts. It is by far the better plan to unite them with a stronger colony than to run the risk of unsettling the bees in the dormant season through the encouragement of wholesale robbing.

"PRACTICAL BEE-KEEPING."

By courtesy of Messrs. Whitcombe and Tombs, Wellington, I am in receipt of a copy of "Practical Bee-keeping," by the late Isaac Hopkins, being the sixth edition of the Australasian Bee Manual. In the preparatory note to the first edition of his Manual, published in 1881, Mr. Hopkins expressed the hope that the book would be the means of assisting to place apiculture on a proper footing in New Zealand, and help to make it as profitable as in England, America, and on the Continent of Europe. He lived long enough to see his hopes fully realized, as New Zealand stands to-day among the more important honey-producing countries in the world. His early influence on the craft was directed towards the adoption of the modified Langstroth hive, and to-day our position is unique in that we have a standardized hive throughout New Zealand. The present edition is full of practical advice, and covers every phase of the art. Mainly devoted to the practical side of the business, it will be found useful to the amateur or advanced beekeeper who is desirous of gaining an insight into honey-production as practised in New Zealand. The book is well and clearly illustrated, and this helps the reader to follow the instructions given in the text. The chapter devoted to the preparation of honey for marketing is especially valuable to the commercial honey-producer. Concise instruction is given on the use of the hydrometer in testing honey for ripeness, and the advice cannot be too closely followed. "Practical Bee-keeping" is up to date, and forms another valuable contribution to the bee-keeping literature of the day. —*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

THE harvesting and storing of the late vegetable crop will now be nearing completion, and care must be taken to avoid attempting the impossible. Too often varieties quite unsuitable for long storage are kept until they are wasted, and samples of varieties that are known for their long-keeping qualities but which are not in their best condition are held too long. A grower must acquire by experience a keen judgment of produce *condition* if he is to make the most of it and avoid waste. During the first few weeks of storage fresh vegetable products give off considerable moisture, and are liable to heat if large quantities are placed in one stack. Losses due to these conditions can

be avoided by giving ample ventilation for a while and maintaining an even temperature.

Where a good rotation of crops is practised vegetable litter may be turned in, but where successive crops of the same or similar kinds are grown, as is unfortunately so often the case through compulsion on high-priced land, all litter should be carefully burnt. Onions, tomatoes, &c., that are planted on the same ground from year to year would be better grown if the fungus-infected foliage were completely burnt up as soon as possible after harvesting. In such cases it is unsuitable for digging in for the humus it might contain; better to burn it and plant a cover-crop that is not affected by the same diseases. By such means, to some extent, are parasitic fungi starved out of the land.

Seedling beds of main-crop cabbage, cauliflower, peas, lettuce, and autumn-sown onions must be kept carefully weeded. Plant out cabbage and cauliflower for early spring cutting. Such crops, after some growth has been made, are sometimes moulded up in windy and exposed localities. Carefully select and set aside seed potatoes. If they have to be obtained from a distance, have them forwarded as soon as they are available. Remember, like breeds like, and the crop will be all the bigger if the seed has been well wintered.

THE PLANTING SEASON FOR TREES AND SHRUBS.

We are now approaching the short period—three or four months—which is regarded as the planting season, in which deciduous and evergreen trees and shrubs may be transplanted with every chance of success. It is an opportunity which demands the careful attention of every man on the land. There are few places where cheap and remunerative improvements could not easily be made by improving, if not planting new shelter-belts and shade-trees. The damage from occasional heavy winds at a critical period of growth exacts a substantial toll from the cultivator of the soil. On good alluvial land a single line of populars is often preferred, and does good work when kept within bounds. One case was seen lately where a great improvement had been made by interplanting privet between the poplars, the result being a fine dense growth between the trunks that afforded shelter where it is often weak and badly wanted. Many shelter-belts would be improved by underplanting, more especially on the windward side.

Successful planting depends more than anything on its suitability to the local soil and climate. Man's skill can contribute something to that success under any circumstances, but it is of little use unless the locality is suitable for the selected trees, each kind and sometimes variety of which has a strong preference for a special environment. A close study of the older plantations in a locality will supply much useful information on this point.

NUTS.

The demand for nuts—as shown by our import statistics—might well receive more consideration from planters. The common bacterial blight of the walnut (*Pseudomonas juglandis*) has prevented many from planting this valuable species, but the headway made against these attacks in other countries is encouraging, and indicates excellent chances

of success if the proper precautions are taken. These trees prefer, and require if planted commercially, a well-drained alluvial soil in a locality that usually has dry summer weather. Planted along the headland of an orchard or paddock they afford useful shade and some shelter. As an avenue on flat country they are very handsome and profitable; or they may be planted in blocks or groves like fruit-trees. Like other trees they vary in susceptibility to blight, and for this reason careful search is being made for the highest possible degree of immunity among the trees in each locality, in order to provide material for propagation. The Persian walnut (*Juglans regia*) — usually known as the English walnut—which is the species most commonly grown, has at maturity a spread usually of 60 ft. This is a fact sometimes overlooked by planters. For the maximum production of nuts the branches of adjoining trees must not interlock.

The sweet or Spanish chestnut is a wholesome nut in considerable demand. It is a good shade-tree, with useful timber, and does best in good hill country.

Hazels, filberts, and cobs, or, as they are known in commerce, Barcelona nuts, have been planted in many localities in the Dominion, but usually they are barren. This is chiefly due to their being planted on heavy land, and allowing strong water-shoots to crowd the trees. They are more thrifty on the poorer land, and should be pruned somewhat like an apple-tree, leaving the leaders well clothed with twiggy laterals. Treated in this way they are doing well in two or three places here, but there seems to be no reason why more successful plantings should not be made, and something more done to supply from our own plantations the keen demand for this popular nut.

HEDGE-TRIMMING AND DRAINAGE.

The trimming-up of hedges before the wood hardens, and the clearing of watercourses and drains to allow a quick clearance from winter rains, is good work at the present time. Much good land devoted to fruit and vegetable culture suffers badly from stagnant water in the subsoil for considerable periods during winter through the drainage, that may have been put in at considerable expense, being more or less obstructed just when it is most needed.

TOBACCO-CURING.

The tobacco harvest will now be completed, and the crop will be undergoing the process known as curing — drying the leaf out to a bright even colour. The most difficult portion of the leaf to cure is naturally the thickest—that is, the stem or midrib. The progress of the operation can best be judged by the condition of the base of the stem where it joins the plant-stalk.

The method of curing leaves on the stalk demands a stripping process, which takes place any time during the winter in a humid atmosphere, when the leaves are in a tough, pliable condition that permits them to be handled without breaking. A stalk is taken from the curing-stick and, holding it in the left hand, each leaf is carefully stripped and placed in its special grade. The leaves are then tied into bundles of one dozen, known as a "hand." They can then be placed astride of the curing-sticks in the curing-shed again, to await the fermentation process of the spring season; or, if the curing is

complete, and it is desired to market them at once, they may be baled up. The latter operation is sometimes indifferently performed; a substantial press is necessary to turn out bales that are firm and compact; only such will stand the necessary handling without depreciation.

In the case of the tobacco being held over, it should be carefully watched during the winter, specially in dull weather, to see that it is not attacked by mould fungus—the result of excessive moisture and a low temperature. Should such a condition threaten, means must be taken to dry the leaf and raise the temperature of the curing-shed.

—*W. C. Hyde, Horticulturist.*

USED MOTOR-OIL FOR ORCHARD-SPRAYING.

USED heavy motor-oil for orchard-spraying during the dormant period has been tried by Mr. C. Calvert, of Myross Bush, Southland. It proved quite effective as an insecticide on old apple-trees badly affected with woolly aphis. The common use of oil-engines and the need for drawing off the used oil from the crank-case occasionally makes this material (which is usually thrown away) generally available in small quantities, but sufficiently large for an application to the domestic or farm orchard. It should be applied during the dormant period in autumn or early spring. Preparation is as follows: Place in a vessel 1½ lb. household soap and 1 gallon oil, and heat them over a fire till the soap is dissolved; remove from the fire, and with a spray-pump thoroughly agitate the contents, at the same time slowly adding ½ gallon water; when the emulsification is complete add 11½ gallons water; the mixture is then ready for use. It is imperative that the water should be soft. Where this is questionable add 2 oz. washing-soda to every 4 gallons water. Rain-water is always to be preferred for the mixing of spraying-compounds. —*Horticulture Division.*

PRESERVATIVE TREATMENT OF FENCING-POSTS.

THE preservative treatment experiments carried out at the Dunedin Exhibition during February and March included tests on over five hundred fencing-posts, consisting of pines, beeches, and kamahi. Satisfactory methods of treatment were developed for all the timbers tested, the times of immersion in the hot and cold baths of creosote in order to obtain ½ in. penetration being as follows:—

	Hot Bath. Hours.	Cold Bath. Hours.
Austrian pine	¾	½
Corsican pine	¾	½
Ponderosa pine	¾	½
Kamahi	4	2
Mountain-beech	6	4
Silver-beech	6	4
Red-beech	3	2½

The estimated cost of treated posts cut from the farm woodlot is between £8 and £10 per hundred. They should have an average life of fifteen to twenty years, thus comparing favourably with the durable untreated posts of native and imported woods, costing from £10 to £18 per hundred delivered on the farm.

—*N.Z. State Forest Service Newsletter.*

POME, CITRUS, AND STONE FRUIT CULTURE IN NEW ZEALAND.

MANY fruitgrowers in this country have an excellent knowledge of the practice of the various operations, such as cultivation, pruning, spraying, and harvesting, necessary for the production of the various fruits, and such men are excellent assistants in the orchard. The owner or orchard-manager, however, who directs these operations can only do this economically and effectually from year to year and with a high degree of success if he has, among other things, a real knowledge and interest in the weather, land, manures, trees, sprays, blights, diseases, and markets, and their relationship to one another. It is possible to manage an orchard by routine with more or less success so far as crop-production is concerned, but it does not necessarily follow that this is economical. At the end of the average season the balance will be small, even when it is on the right side.

It is not sufficient, for instance, to prune an orchard on some recognized system. An assistant can do that quite well; but the efficient manager must lay down the policy for pruning each kind and variety from year to year—whether the trees should be pruned hard or lightly, or merely thinned, &c. Even in a block of one variety there are sure to be a few stunted trees and one or two of particularly rank growth, which in both cases will require individual treatment. This demands an intimate knowledge of the structure and functions of the tree and the special habits of each variety. And so with spraying: an assistant can carry out an elaborate spray programme without supervision. The efficient manager, however, will have specially diseased trees marked down when pruning and give them special treatment. He will have a knowledge of the peculiar susceptibility or immunity of each variety to certain diseases, and of the effect of any kind of weather at all seasons in assisting or retarding those attacks. With this knowledge he will introduce differential spraying with considerable economy, and in difficult years with a higher percentage of success. And so on with every important factor of the industry, an intimate knowledge of the underlying causes and a quick intuition are necessary.

This phase and its importance might well receive more attention from owners and orchard-managers, and those who aspire to that position. Good literature along these lines is scarce, and specially that which deals with New Zealand conditions, which naturally are very different from those on the Continents of America and Europe. Our Dominion growers are fortunate in now having at their command such a work as "Fungous Diseases of Fruit-trees in New Zealand and their Remedial Treatment," by G. H. Cunningham, M.Sc., Mycologist, Department of Agriculture, published by the New Zealand Fruitgrowers' Federation. This work deals with practically all the serious fungous diseases—and many others—which affect pome, stone, and citrus fruits in the orchard and storeroom.

Take the example of that fungus which levies such a heavy toll of our stone-fruit crop—brown-rot. Under that heading we are given its scientific name and a list of synonyms, both scientific and popular, under which it has been known in the past and elsewhere—information which immediately dispels a cloud of misunderstanding. There follow some notes on its history and introduction into this country. A very complete statement then follows each of these headings: Appearance and Effect on the Hosts, Economic Importance, Life-history of the Organism, and Considerations Regarding Control, finishing with a brief and useful summary of the information that is so useful during hurried moments when one wishes just to refresh the memory. The statement is illustrated with abundant plates from excellent photographs of affected leaves, twigs, and fruit, as well as original line drawings of important sections as seen under the microscope. Illustrations, upon which the practical man depends so much for the identification of disease, are most important, and are here supplied in an exemplary manner. In a similar manner the other fungi affecting fruit-trees are dealt with, the whole work being made convenient for ready reference by an excellent range of type such as is rarely found in such works.

An unusual feature in works of this class are four chapters dealing with "Remedial Treatment," in which the subject is fully dealt with in a modern manner, and one that is suitable for this country. A chapter dealing with losses in fruit crops due to disease includes valuable tables of varieties of fruit highly and moderately susceptible to the different fungi, also the desirable varieties that

are resistant. What economies in spraying might have been made in the past with a better knowledge of this section!

One of the most valuable sections of the book is that on the botany of the fruit-tree, which deals with the cell and its contents, the structure and functions of root and branch, and the leaves and fruit—that, too, in lucid language as free as possible from technical terms. With its excellent illustrations and readable text this information is supplied in a manner that makes its assimilation by the reader easy and pleasant.

It will be seen that the book covers a far wider range than its title would suggest. Many of the fungous diseases had been dealt with previously by Mr. Cunningham in this *Journal*, but that section has now been consolidated, and the work expanded into what almost amounts to an orchardist's handbook. As a contribution to the economy of fruit-culture in this country the book is valuable and unique.

W. C. H.

WINTER FARM-SCHOOLS, 1926.

THE Department of Agriculture has arranged short courses of instruction for farmers in the various districts as follows:—

Auckland.—(1) At Dargaville, 17th to 21st May; (2) at Whangarei, 24th to 28th May; (3) at Hamilton, 31st May to 4th June. Enrolment with Instructor in Agriculture, Department of Agriculture, Auckland.

Taranaki.—At New Plymouth, 5th to 10th July. Enrolment with Instructor in Agriculture, Department of Agriculture, Wanganui.

Hawke's Bay.—Travelling school, 27th June to 3rd July. Enrolment with Instructor in Agriculture, Department of Agriculture, Hastings.

Southern Hawke's Bay and Wairarapa.—Travelling school, 12th to 17th July. Enrolment with Instructor in Agriculture, Department of Agriculture, Palmerston North.

Marlborough.—Travelling school, 22nd to 26th June. Enrolment with Instructor in Agriculture, Department of Agriculture, Blenheim.

Canterbury.—Travelling school, 10th to 22nd May. Enrolment with Instructor in Agriculture, Department of Agriculture, Christchurch.

Otago.—Travelling school, 7th to 15th June. Enrolment with Instructor in Agriculture, Department of Agriculture, Dunedin.

Southland.—Travelling school, 16th to 19th June. Enrolment with Instructor in Agriculture, Department of Agriculture, Invercargill.

Westland.—Travelling school, 19th to 24th July. Enrolment with Fields Instructor, Waimaunga Experimental Farm, Mawheraiti.

Details of the respective schools (programme, accommodation, &c.) will be published in the local Press in each case. Any further information desired may be obtained from the individual enrolling officers. Early enrolment is advisable.

Wheat and Oats Threshings.—Returns of actual threshings up to 19th March received by the Government Statistician from threshing-mill owners showed that until then 752,712 bushels of wheat and 415,744 bushels of oats had been threshed out. The average yields per acre in cases where particulars of areas were furnished (covering 99 per cent. of total threshings) worked out at 29·93 bushels for wheat and 33·47 bushels for oats. The figures for the Canterbury and Otago Land Districts respectively were as follows: Canterbury—Wheat, 650,152 bushels threshed, averaging 29·77 bushels per acre; oats, 291,677 bushels threshed, averaging 39·93 bushels per acre. Otago—Wheat, 48,804 bushels, averaging 37·17 bushels per acre; oats, 96,805 bushels, averaging 43·47 bushels per acre. No threshing returns had been received from Southland at the date referred to.

Correction.—In the Red Poll class-averages for 1925, at top of page 165 in last month's *Journal*, the word "senior" in the third line should be omitted, and the words "Three-year-old" substituted for "Mature" in second line of table.

IMPORTATION OF PEDIGREE STOCK INTO BRITAIN.

CONDITIONS FOR LANDING AND FORM OF APPLICATION

THE following memorandum of conditions under which the Minister is prepared to consider applications (under section 1 of the Importation of Pedigree Animals Act, 1925) for the landing in Britain of such stock was issued, together with the form of application, by the British Ministry of Agriculture in July last, and is here reproduced for the information of those concerned.

Conditions for Landing.

1. Section 1 (1) of the Importation of Pedigree Animals Act, 1925, enables the Minister to make orders authorizing, subject to the conditions prescribed in such orders, the landing of cattle, sheep, goats, or swine brought from any part of His Majesty's dominions, which are shown to the Minister's satisfaction to be there registered as pedigree stock in a herd or flock book recognized by him after consultation with the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland, to be landed in Great Britain without being subject to Part I of the Third Schedule to the Diseases of Animals Act, 1894 (Slaughter at the Port of Landing) but subject to Part II of that schedule (Quarantine).

2. The Act of 1925 also provides that no such order may be made except with respect to animals brought from a part of the dominions in which pedigree animals from Great Britain are allowed to be landed either unconditionally or subject to conditions (including rates of import duty) which in the opinion of the Minister are not unduly restrictive.

3. Before authorizing the landing of any animal under the Act of 1925 the Minister will require to be satisfied in the case of each application that the above-mentioned conditions are complied with, and also that no risk of the introduction of disease would be entailed by the conditions existing in that part of His Majesty's dominions from which the animal is proposed to be imported. A certificate will be required from the Government of the exporting country as to the freedom from disease, immediately before shipment, both of the animals and of the country from which they are brought. The certificate in the case of cattle should show that each animal has been submitted to the tuberculin test within one month immediately prior to shipment and has shown no reaction. The temperature-charts should be attached to the requisite certificate in cases where the subcutaneous tuberculin test was carried out. In cases where the intradermal, or intrapalpebral, or ophthalmic tests have been carried out (either independently or in conjunction with the subcutaneous test) an accurate description of the reaction, if any, should be inserted on the certificate.

4. The landing of the animals, if authorized, will be subject to the provisions of the special order of the Minister authorizing the landing, and regulating the detention and isolation of the animals at a quarantine station at the port of landing to be defined by the order, and imposing strict requirements as to inspection of the animals during quarantine, and the cleansing and disinfection of the premises, &c. No forage or litter that has been in contact with the animals to be imported may be landed. The Ministry will reserve to itself the right to retest any cattle in the quarantine station in any case in which it considers such a test necessary.

5. In the case of each importation a period of quarantine will be specifically imposed by the order authorizing the landing, which will not usually be less than twenty-eight days, and which, in certain cases, would be extended to six months.

6. It rests with the importer to make the necessary arrangements for the acquisition of premises to be used as a quarantine station (subject to the approval of such premises by the Ministry) and for the care of the animals, and to defray all expenses connected with the importation and with the detention of the animals during the period of quarantine, except the expenses incurred in the veterinary supervision of the animals during that period, which would be undertaken by the Ministry without charge, provided that the port is one at which a Veterinary Inspector of the Ministry is stationed.

7. The premises selected for quarantine must meet the requirements of the Ministry as regards structure and suitability, and be in close proximity to the wharf at which the animals are landed. Definite arrangements for shipment

should in no case be made until authority for the importation has been granted by the Minister and the place of quarantine approved.

8. In no case will the Ministry accept any liability for any loss occasioned at any time by the death or illness of any animal imported under the Act, or by any accident or injury to any such animal. No compensation is payable under the Diseases of Animals Acts in respect of any animal which, having been allowed to be landed under the Act of 1925, is slaughtered in a quarantine station by reason of its being diseased or suspected of disease, or of its having been exposed to the infection of any disease.

Form of Application.

MINISTRY OF AGRICULTURE AND FISHERIES.

DISEASES OF ANIMALS ACTS, 1894 TO 1925.

Application to the Minister of Agriculture and Fisheries for Permission to land Pedigree Animals, subject to Quarantine, in accordance with the Provisions of the Importation of Pedigree Animals Act, 1925.

1. Full description—*e.g.*, number, species, sex, of the animals for which permission is desired :
2. Name of port and country whence the animals are to be shipped, and place of their origin :
3. State name of herd or flock book in which the animals are entered (evidence of this will be required—*e.g.*, the registered numbers and names, if any, of the animals) :
4. Address of keeper of the herd or flock book referred to in 3 :
5. Name of the port in this country at which the animals will be landed :
6. Names of ports at which the vessel bringing the animals will touch on the voyage :
7. Full description of premises proposed for definition as a quarantine station for the purpose of the landing and quarantine of the animals, and name and address of the occupier :
8. Name and address of applicant :

I have read the conditions printed on the back of this form, and agree that, in the event of my application being authorized, I will comply with those conditions, and any other conditions, as to quarantine or otherwise, subject to which the Minister may authorize the landing of the animals.

I also agree to accept all responsibility for all expenses incurred in connection with the importation, and for any loss occasioned by the death or illness of the above-mentioned animals, or by any accident or injury to the animals, whilst in quarantine or subsequently

[*Signed*]

Date : , 19

N.B.—*This application must be made before the animals are embarked, and cannot be entertained unless the Ministry is placed in possession of full particulars.* The replies to the above questions should therefore be as complete as possible, and the application should be addressed to the Secretary, Ministry of Agriculture and Fisheries, Whitehall Place, London S.W. 1.

FORTHCOMING WINTER SHOWS.

Flaxbourne A. and P. Association : Ward, 12th May.
Franklin A. and P. Association : Pukekohe, 28th and 29th May.
Otago A. and P. Society : Dunedin, 1st to 4th June.
Waikato Winter Show Association : Hamilton, 1st to 5th June.
Auckland Winter Exhibition : Auckland, 9th to 19th June.
Manawatu A. and P. Association : Palmerston North, 15th to 19th June.
Wanganui A. and P. Association : Wanganui, 24th to 26th June.
Wellington Show Association : Wellington, 10th to 24th July.

WEATHER RECORDS: MARCH, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

ATMOSPHERIC pressure was above normal during the greater part of March, and dry weather predominated; but some heavy and welcome rains occurred about the 23rd, 27th, and 31st. On the 23rd a small but rather intense cyclonic disturbance passed through Cook Strait, and this was followed by another on the 26th.

Rainfall was above the average for the month in the Wellington, Nelson, and Marlborough districts, also at Hokitika, Westport, and Otira; it was also above the average at Kawhia, but less than usual for the month of March in all other parts of the Dominion.

Westerly gales were experienced about Cook and Foveaux Straits on the 7th, 8th, and 9th, and severe winds also occurred about the 23rd and 31st. Generally, however, there was little wind during the month.

Conditions were, on the whole, mostly cool and fair. The rains during the latter part of the month eased the situation for farmers in many parts of the country, particularly in the North Island, and will, it is hoped, produce growth for winter feed.

—*D. C. Bates, Director.*

RAINFALL FOR MARCH, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	1·96	9	0·79	3·58
Russell	1·80	9	0·64	3·42
Whangarei	0·67	7	0·38	5·10
Auckland	2·42	9	0·92	3·03
Hamilton	2·88	13	0·94	3·74
Kawhia	3·66	10	1·04	3·12
New Plymouth	3·48	12	0·74	3·62
Riversdale, Inglewood	6·49	11	1·82	7·39
Whangamomona	4·95	10	1·34	5·46
Tairua, Thames	4·26	7	1·70	6·73
Tauranga	2·99	9	1·02	4·16
Maraehako Station, Opotiki	2·68	9	0·90	3·90
Gisborne	0·79	12	0·20	4·51
Taupo	2·15	5	0·92	3·53
Napier	1·06	6	0·36	3·29
Maraekakaho Station, Hastings	0·87	7	0·40	3·10
Taihape	1·69	11	0·67	2·95
Masterton	1·98	5	1·04	3·15
Patea	3·38	8	1·32	3·60
Wanganui	2·03	6	1·00	2·60
Foxton	2·56	5	2·00	2·36
Wellington	4·45	7	2·45	3·28
South Island.				
Westport	6·00	12	1·62	5·80
Greymouth	7·35	14	2·28	9·12
Hokitika	12·91	13	5·78	9·72
Ross	14·72	13	6·39	10·35
Arthur's Pass	10·53	10	3·01	5·84
Okuru, Westland	8·12	12	2·59	15·48
Collingwood	10·75	9	4·25	4·19
Nelson	3·54	7	2·55	3·08
Spring Creek, Blenheim	3·32	5	1·70	1·81

RAINFALL FOR MARCH, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Tophouse	3·47	7	1·53	3·44
Hanmer Springs	2·31	5	1·70	2·92
Highfield, Waiau	1·86	5	1·20	3·09
Gore Bay, Cheviot	1·30	6	0·93	2·14
Christchurch	1·23	8	0·76	2·05
Timaru	1·46	7	0·92	2·45
Lambrook Station, Fairlie	1·74	4	0·87	2·58
Benmore Station, Clearburn	1·73	4	1·02	2·64
Oamaru	0·83	7	0·44	1·77
Queenstown	1·15	4	0·64	2·63
Clyde	0·51	3	0·37	1·50
Dunedin	1·38	9	0·42	2·99
Wendon	1·28	5	0·40	2·93
Gore	1·40	11	0·61	3·23
Invercargill	2·04	13	0·84	3·86
Puysegur Point	5·79	15	1·32	8·00

REGULATIONS REGARDING THE GRADING OF POTATOES FOR SALE IN NEW SOUTH WALES.

THE following official regulations governing the grading of potatoes for sale in New South Wales include in their application importations into that State, and must therefore be observed by exporters of New Zealand potatoes :—

There shall be two grades of potatoes—viz., No. 1 grade and No. 2 grade. These grades shall consist of potatoes which are sound, of similar varietal characteristics, and of normal shape, practically free from dirt and other foreign matter, and not affected by second growth, sprouting, injury, or deterioration.

Potatoes of No. 1 grade shall, in the case of round varieties, be not less than 2½ in. in diameter, and, in the case of long varieties, shall be not less than 2 in. in diameter. The diameter of potatoes in No. 2 grade shall not be less than 1¾ in.

Potatoes shall be deemed to comply with the above-mentioned grades if at least 92½ per cent. by weight thereof comply with the requirement as to size, and if at least 95 per cent. by weight comply with the other requirements of the said grades.

Potatoes shall not be packed for sale or sold unless they comply with one of the grades mentioned in the preceding regulation and unless the grade is legibly written on the covering in letters not less than 2 in. in height : Provided that (*a*) potatoes which are intended for planting and which comply with the requirements of the above grades except as to size may be packed for sale or sold in coverings which are legibly marked "Seed Potatoes" ; and (*b*) potatoes which are intended for stock-food and which do not comply with the above grades may be packed for sale or sold in coverings legibly marked "Stock Food."

Bees and Fruit-tree Spraying.—In his book "Practical Bee-keeping" the late Isaac Hopkins remarks on this subject as follows : "I understand from those well up on the subject that it is wrong in principle to spray fruit-trees for codlin-moth with the usual poisonous mixtures while in blossom. This I do know, that to do so not only destroys the fructifying pollen-grains, but also kills the bees which visit the flowers, and thus prevents cross-fertilization. In some of the American States there are laws which make it penal to do so. I am informed that it is not frequently done in New Zealand, and I am pleased to hear it."

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

GROUND LIMESTONE AND BURNT LIME.

R. H., Devonport :—

Kindly inform me what are the relative values of ground lime rock and the ordinary burnt lime in (*a*) effect upon the mechanical condition of the soil, (*b*) effect upon making the plant-food available, (*c*) quantity per acre necessary.

The Fields Division :—

With reference to your queries (*a*) and (*b*) : You are no doubt aware that the ground lime rock mainly consists of carbonate of lime. When this is burnt there is a loss of weight of about 44 per cent. and there results a new substance with different properties. Burnt lime acts more quickly because it is partly soluble in water, and it is more evenly divided, hence it becomes better distributed throughout the soil. In the second place, its effect in ameliorating clay soils is quicker and better than that of ground carbonate of lime. Again, lime in solution has an effect of acting upon the organic matter in the soil and making available useful plant-foods contained in the organic matter. Further, it is claimed by soil investigators that burnt lime—but not ground limestone—has a beneficial effect on the small forms of life found in the soil. It promotes greater bacterial activity, and consequently increases the available nitrates. In reacting upon the organic matter of the soil it thereby supplies food for the bacteria and other useful forms of life in the soil. Concerning actual field evidence in New Zealand regarding the points referred to, there is very little information, especially from systematic field experiments. On the clay gum-lands at Puwera, burnt lime gave better results in bringing about good tilth than ground carbonate of lime. Our practice in New Zealand is based mainly on the experience of other countries, notably Great Britain and America. In the latter it is held that, taken over a period of years, ground carbonate of lime is better than burnt lime. This is supported by English experience. For agricultural purposes, ground carbonate is the form chiefly used by farmers in New Zealand. As to your query (*c*), quantity per acre necessary : This can be better determined after your soil has been analysed. Generally speaking, 15 cwt. to 20 cwt. per acre of ground carbonate is commonly applied on land that has not been limed previously, and approximately half that quantity of burnt lime if the latter form is used. Where freight is a consideration, burnt lime is often cheaper to use. Burnt lime is objectionable because of the difficulty in applying it, both for men and horses. Again, when stored in bags in our damp climate it slakes and bursts the bag.

RICE AS A POULTRY-FOOD.

J. B., Southbrook :—

Would you please state the food value of rice-flour (ground, unpolished rice) as a poultry food, and in what proportion it should be used in the place of wheatmeal with bran, in the mash ? Would it be suitable for other than winter feeding, and is it of value in egg-production ?

The Live-stock Division :—

For promoting egg-production we would not recommend the feeding of rice in any form, as it does not contain sufficient of the elements necessary for a high yield. If, however, it can be purchased at a low cost as compared with wheat-meal there is no objection to a small portion of rice-meal being included in the mash—say, a half part with one part wheat-meal and two parts bran ; but owing to the low protein content of rice it would be necessary to add a fair amount of animal food to the ration in order to secure the best results. For growing stock an amount of rice-meal double that stated above might be used.

SUBTERRANEAN CLOVER AND LUCERNE.

A. B., Woodville :—

Could you enlighten us as to the feeding-value of subterranean clover, and as to whether a crop of it would compare favourably with lucerne ? The plan we have set is to put down about 15 acres of this clover this autumn for early feed next spring ; feed it hard until the end of November, then allow it to seed ; after seeding, feed it off, give the paddock a double stroke of the disks, manure, and roll. Should this be successful ? We understand the plant is the only one to retain its fattening qualities after seeding. Is this so ?

The Fields Division :—

Owing to the high cost of subterranean-clover seed, which is extremely difficult to harvest, only small quantities have been sown in New Zealand, and it is recommended exclusively for incorporation in mixtures suitable for light sand-dunes, the lighter, poorer classes of hill country, on bracken burns, and on sharp gravelly soils. It is a native of the drier parts of Europe, Asia, and Africa, and hence is suited to such conditions where the better clovers may not be profitable. Subterranean clover can in no way be compared with lucerne either for yield or feeding-value, being only an annual, germinating with the first autumn rains, and yielding herbage during winter, spring, and early summer. The growing-period would be practically over by November, and it would be advisable not to stock too heavy at that time, so as to encourage its rapid spread. There is no necessity to either disk or roll the paddock, but certainly a dressing of a quick-acting phosphate, such as super, would increase the rapidity of growth. With reference to the fattening-qualities of subterranean clover after seeding, probably you refer to the seed-heads being a concentrate, but it is doubtful whether this can be counted on, as under ordinary soil-conditions only about 20 per cent. of the seeds remain to ripen above ground. From this point of view it could not be compared, for instance, with the Australian burr clover, which in drought periods is sometimes the sole maintenance of stock in parts of those States. We are of opinion that in your case a pasture composed entirely of subterranean clover would not prove economical, as during summer the paddock would be practically bare, and thus allow the influx of weeds or worthless grasses.

SUSPECTED PHOSPHORUS POISONING IN EWES.

W. E. T., Waiau :—

Some ewes were suspected of being poisoned by phosphorized pollard laid for rabbits. How can one be sure of this ? And how long would a ewe take to die after picking up the pollard ?

The Live-stock Division :—

Phosphorus is a corrosive poison, and causes gastro-enteritis, manifested by great thirst, purging, and vomiting, the vomit being of a dark-green colour. Symptoms vary with the amount of the poison taken and the amount of food in the stomach and intestines. If the dose taken is large, the symptoms exhibit themselves very rapidly, and death takes place in a few hours. With a lesser dose it may be five or six hours before the symptoms appear in the form of colicky pains, tenderness of the abdomen, and a diarrhœa in which the excrements have the characteristic smell of phosphorus. Delirium, convulsions, and coma appear shortly before death, which may take place within a day, or may even extend to twelve days according to the amount taken. On *post mortem* examination the contents of the bowel give off the characteristic smell, and if placed in the dark have a luminous appearance. In chronic poisoning with phosphorus (where the animal is receiving small doses for some time) the heart, liver, kidneys, &c., show a fatty degeneration, in which case they have a yellowish appearance.

When dairy cows are dry, succulent and highly nitrogenous feeds are not necessary. Rough winter feed on pastures, grass hay, and roots, swedes, turnips, or mangolds are all suitable.

The New Zealand

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THE GRASSLANDS OF NEW ZEALAND.

SERIES II. THE MID-WEST NORTH ISLAND HILL COUNTRY.

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

4. DETAILED REVIEW OF GRASSES AND CLOVERS FOR HILL COUNTRY.

IN the June, 1925, issue of this *Journal* (pages 357–74) an effort was made to classify the pasture species and to outline those factors which in the main are responsible for change in the composition of pastures. It is intended in this and subsequent articles to deal with the individual grasses and clovers, particularly in regard to the position each occupies, or should occupy, on hill country such as that predominating in the mid-west districts of the North Island.

Before considering in detail the relative position of each grass and clover for the hill country in question it may be worth while to discuss a few fundamental truths in regard to hill country in general. Viewed broadly, most hill country differs widely from the fertile plain (Fig. 43). No farm implement aids the settler in his efforts to secure a good seed-bed or to ameliorate the soil by exposing it to the recuperative influence of air and sun. The primary forest burn provides a good seed-bed and a plentiful supply of plant-food for the first few years, but with the large tracts reverted to secondary growth the seed-bed is hard and the supply of plant-food often scanty. In both primary and secondary burns there is a great diversity of seed-beds (Figs. 44–47)—easy sloping foothills, steep slopes, gullies, ridges, subsoil outcrops (sandstone, papa, limestone, greywacke, and the like), rubbly places, shingle-slips, land-slips, wet seepage-places, small swampy areas, dry, hard knolls, pukahu and other unconsolidated surfaces, volcanic deposits (pumice, &c.)—and on all sides the competition of the secondary growth manifesting itself after the fire or following on certain specific methods of farming the country. Shady and sunny slopes also greatly complicate the problem of grassing and of managing the country.

It is this variation in seed-bed, in soil, and in aspect that makes one ponder in considering the grasses and clovers that should be sown.

There is still a wide persistence in the belief that it is possible to establish and maintain good rye-grass, cocksfoot, white clover, &c., on hill country, and the invasion among these species of so-called inferior grasses is looked upon as a great misfortune.

All change in composition of pastures can be directly traced to a set of causes reflecting upon the individuality of the species. Each species has more or less its set station, defined by the plant-food available, the amount of light and shade persisting, the measure of heat or cold, of wetness or dryness, the consistency of soil-particles—whether heavy soils, light soils, consolidated or unconsolidated soils—and chemical composition—whether limestone, saline soils, &c. Upon these depend the growth of the individual and subsequent change in composition of pastures. Change seems to be governed almost entirely

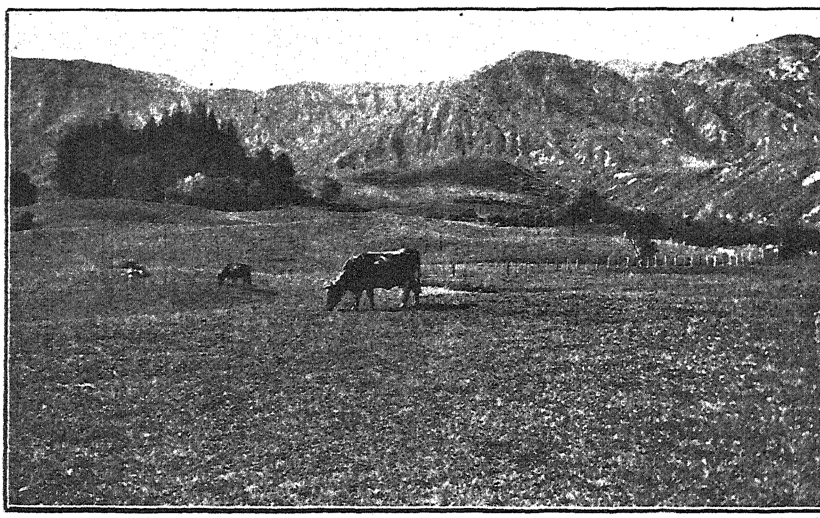


FIG. 43. THE EASIER PLOUGHABLE COUNTRY WHICH CAN BE IMPROVED AT WILL BY THE FARMER, AND THE HARDER PROPOSITION BEYOND.

[*Photo by E. B. Levy.*

by bulk or quantity of herbage produced by the individual species within the pasture association. Certain grasses and clovers are capable of producing more bulk than others; thus rye-grass, properly natured, produces immensely more bulk of herbage than does danthonia similarly well natured. The species that produces the greatest bulk, therefore, is destined to become the dominant one within any pasture association. Management, of course, plays an enormous part, and the governing of bulk in pastures by careful management is one of the fundamentals of good pasture establishment, utilization, and maintenance.

When carefully studied the direction of change in pasture-composition indicates very clearly the conditions existing within that pasture sward, and it is only by interpreting these changes aright that we can get down to bed-rock so far as sound pasture-management is concerned. In the past we have often misinterpreted Nature in her effort to keep

the soil-surface covered by some form of vegetation. We must remember that plant-forms have been evolved through ages of time, and that during that period a plant, or plants, have been evolved to fit almost every conceivable situation. It is for the farmer to so manage conditions and environment that the plants he wishes to see on his farm may have the correct conditions for their proper growth. Where it is not economically sound to alter conditions, then every effort should be made to get species established that are suited to his particular conditions, rather than waste money on the sowing of other species that are quite unsuited to the country he is endeavouring to grass. With most hill country in New Zealand we have got to get away from the idea that the country is good enough for rye-grass. We must sow for all aspects, not just for those pockets of better soil and easier aspect.

How often has the farmer been inclined to vent his wrath on poorer, inferior grasses or weeds coming in and replacing his better grasses that cost him so much hard cash, time, and labour to sow! Were the signs of the development properly interpreted and heeded, these would signify something wrong with the soil conditions or management of the pasture, which when corrected would give rise to something nearer the type of pasture the farmer desired to see. Just what the appearance or disappearance of each plant means or signifies in grassland does not come within the scope of this article, although this phase of pasture-study is one of intense interest and value. It suffices for the present to say that, given the right set of conditions, there is practically no inferior grass or weed that can compete successfully with vigorous strong-growing rye-grass, cocksfoot, and clover. When these are sown, therefore, and inferior grasses and weeds make their appearance in the pasture, this is a certain indication that conditions have become unfavourable for the proper growth of the rye-grass, cocksfoot, and clovers.

Turning again to the early primary forest burn, with its remarkable growth of grass for the first few years and its turnip crop within the first six months, what a splendid indication there is of wealth left in the wake of a good burn. In the development of the North Island forest country was it any wonder that men were deceived by the early promise? Then, again, we have in New Zealand certain wonderful areas of forest hill country, typified by much of the Rangitikei County, which is still holding a very fair proportion of the best English grasses originally sown. Pioneers from this fertile block went farther afield and tackled country similarly forested, putting into operation the same practices as those so successfully applied in the Rangitikei. But surface-soil conditions and the favourable climate for secondary growth —ferns, scrub, &c.—made the experience of the Rangitikei of little value. Further experience had to be gained, different methods had to be employed, larger expenditure was necessary. Where the farmer was unable to adapt himself to the new conditions or to bear the additional expenditure for the necessary fencing, crushing, &c., to-day we see these areas more or less covered with rank secondary growth. The task of winning back that reverted country is one of the leading pastoral problems New Zealand has to face at the present time. The species of grasses and clovers originally sown on the country now reverted to secondary growth contributed in no small measure to the failure of that country to become grassed.

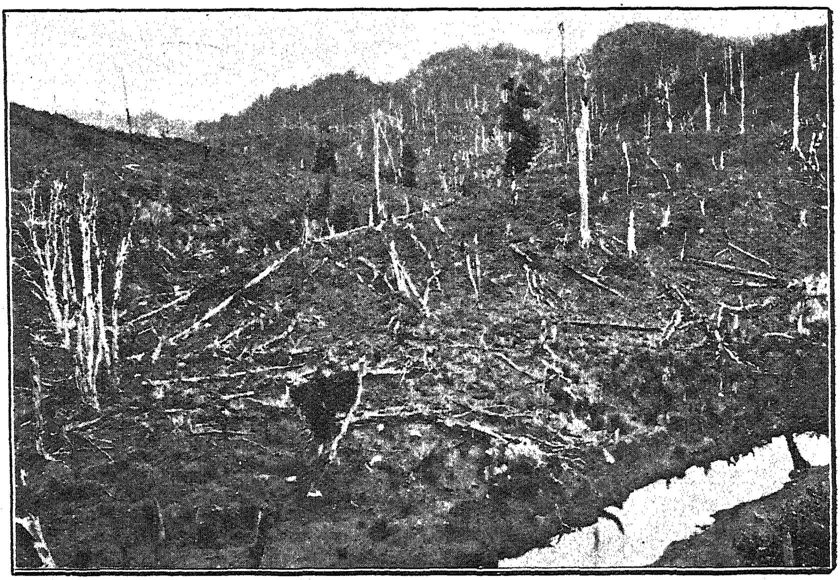


FIG. 44. EASY SLOPING FOOTHILLS, WITH STEEPER SLOPES RUNNING TO BEECH RIDGES IN THE BACKGROUND.,

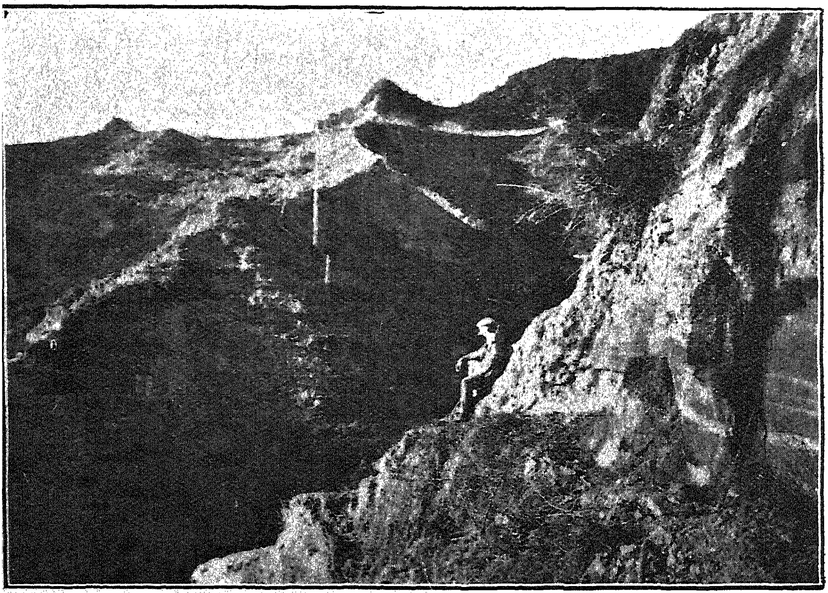


FIG. 45. SHADY SLOPES AND SUNNY SLOPES: PAPA AND SANDSTONE OUTCROPS.

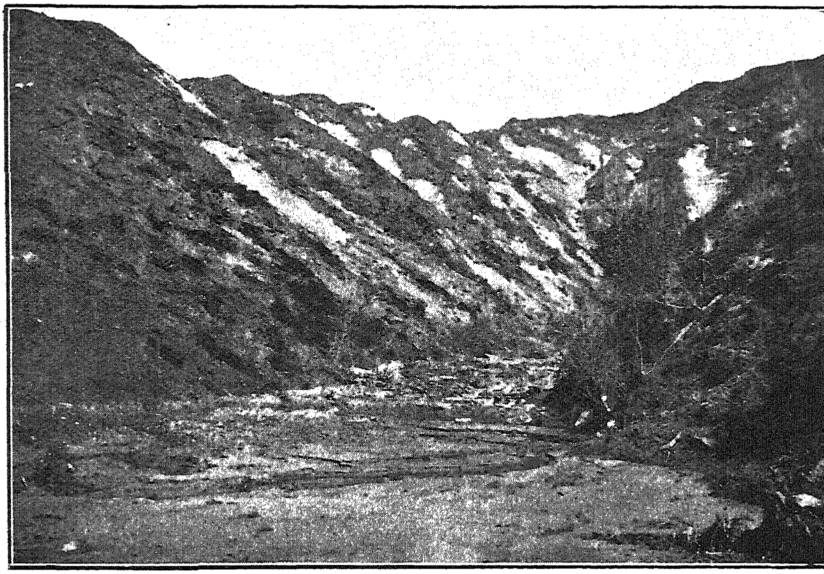


FIG. 46. SLIPS AFTER HEAVY RAIN, PRESENTING A VERY DIFFICULT SEED-BED.
In the foreground is a swampy area newly formed from debris from the hills and slips.

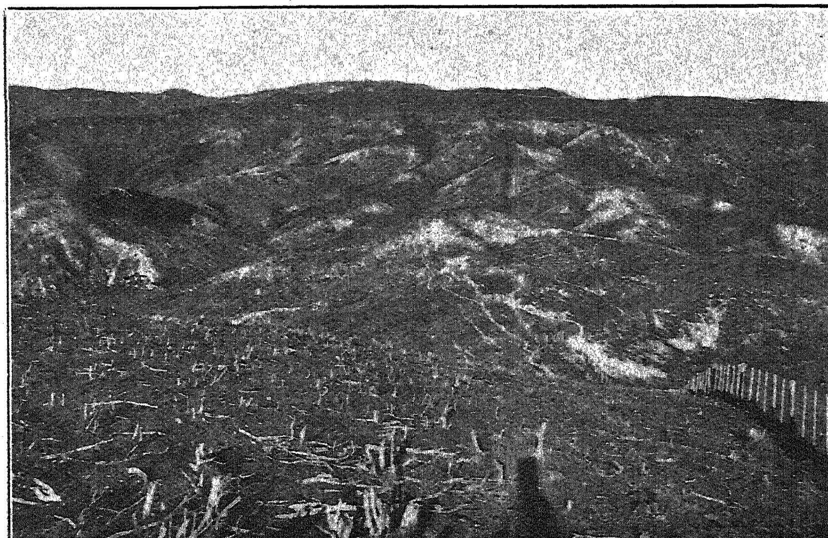


FIG. 47. IN BACKGROUND, HARD FACES WITH STUNTED MANUKA BURN, WHERE THE SEED-BED IS ALMOST HOPELESS FOR MUCH RESULT FROM ANY SEED SOWN.

[*Photos by E. B. Levy.*

MAJOR DEVELOPMENTS ON HILL COUNTRY FROM THE INITIAL PRIMARY BURN.

Viewing the hill country of New Zealand as a whole, we find that the development has taken four very definite courses from the initial primary burn (Fig. 48).

In the first case the forest has been felled and badly burnt; the burn is unfenced and trackless, prohibiting stock from working over it. Here development in a few years after the burn results in a mass of fern and scrub growth — the initial stages of forest-regeneration (Fig. 49).

FIG. 48. A PRIMARY FOREST BURN.

From this stage four major developments in the history of hill-country grasslands have taken place. [Photo by E. B. Levy.

In the second case (Fig. 50) the development has also resulted in secondary growth—bracken fern, hard fern, manuka, &c.—but after a profitable grassland period varying from six to ten years. The grasses sown were in the main first-class English grasses and clovers—rye-grass, cocksfoot, Poa pratensis, timothy, red and white clover, &c.—which kept going well until the reserve plant-food of the forest burn was used up. With a reduction in fertility these gross feeders were not adequately nourished, and a dwindling of each grass took place, resulting finally in the production of a weak, open turf. With a much reduced carrying-capacity stock could no longer be maintained on the areas in sufficient numbers to control the secondary growth, which gained rapidly on the weak, open turf. Once such growth established and stock withdrawn, it was a matter of a short time only before the

practical annihilation of the weak pasture-plants was accomplished. This second development — primary forest burn, good grass for a period, weak, open turf, and finally secondary growth — is fairly characteristic of the wetter portions of the west coast of both the North and South Islands.

The third development—perhaps the major development—on hill country in New Zealand is characterized by the formation of a permanent grass cover formed largely by species other than those sown in the original mixtures applied to the forest burn, but which have come in later, unbidden as it were, as soon as the first-class grasses sown weakened and the turf opened up (Fig. 51). We see in these two latter developments a similarity for the first six to ten years—rye-grass, cocksfoot, &c., following the burn, a corresponding decrease in fertility, and a similar weakening of species and opening-up of the turf. At the weak, open-turf stage the development forks. In the one direction we get an encroachment of secondary growth, and in the other the development of a grass turf formed by hardier, second-rate grasses and clovers, such as danthonia, brown-top, paspalum, ratstail, suckling-clover, &c. This latter development is characteristic of the somewhat drier hill country of the east coast and northern part of the North Island, and of the north of the South Island. It is also fairly characteristic of farms within the secondary-growth zone where the farmer had a sufficiency of stock to crush out such growth whenever it put in an appearance. Temporary phases of secondary growth also often characterize the development to hardier grasses (danthonia, brown-top, &c.), but the elimination of this growth is made very much easier by the ability to burn.

The fourth development on hill country—unfortunately, over only a comparatively small area — has consisted in a slight reduction of the first-class grasses and virtually no development of secondary growth (Fig. 52). About Mangaweka and Taihape, in the Rangitikei County, and on certain more favoured areas in Hawke's Bay and in the Wairarapa, may still be seen hill country holding the majority of the English grasses sown—cocksfoot, Poa pratensis, white clover, and a fair sprinkling of rye-grass. The turf—at any rate, where at all well managed — has remained sufficiently closed to prevent the entrance of either secondary growth or the hardier grasses (danthonia, brown-top, &c.). Even on this good hill country, however, where hard continuous grazing characterizes the farming, danthonia is making rapid headway (Fig. 53).

From the experiences, then, of the past we come to the following conclusions regarding the grassing of hill country:—

(1.) Where the soil is sufficiently strong and conditions are fairly easy there is no secondary growth and scarcely any appearance of the inferior, hardier grasses and clovers.

(2.) Where the soil has lost its original fertility, or where conditions are hard, the development has been either to secondary growth or to hardier grasses and clovers.

(3.) The appearance of weak turf, secondary growth, or inferior grasses is a certain indication of conditions too hard for the better English grasses and clovers. For these to become dominant again conditions must be made easier and surface fertility built up. Where

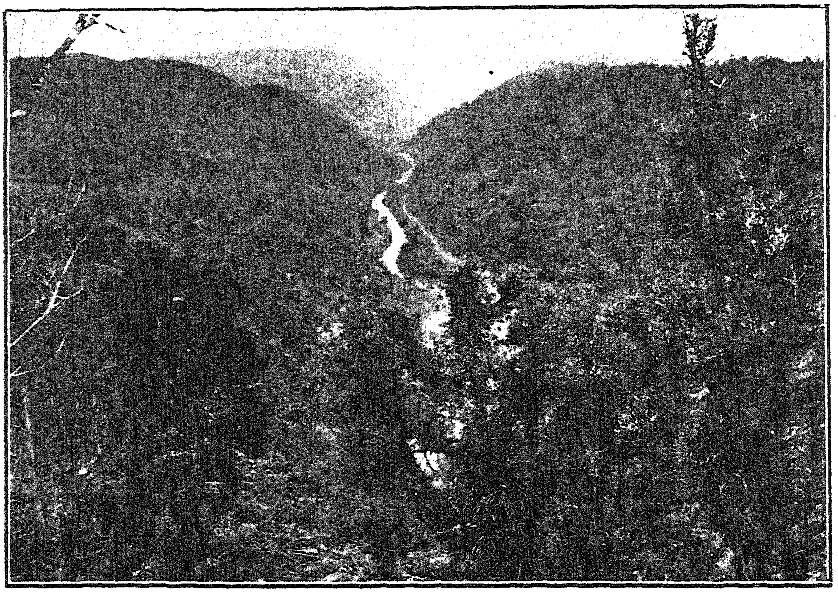


FIG. 49. FIRST DEVELOPMENT: PRIMARY BURN TO SECONDARY GROWTH WITHOUT ANY PROFITABLE GRASSLAND PERIOD.

In foreground, new felling ready for the match; on right, the primary forest; on left, a block of reverted country.

FIG. 50. SECOND DEVELOPMENT: PRIMARY BURN TO SECONDARY GROWTH AFTER A PROFITABLE GRASSLAND PERIOD OF ABOUT FIFTEEN YEARS.

Hard fern on slopes in middle distance and foreground induced by close and continuous grazing with sheep.

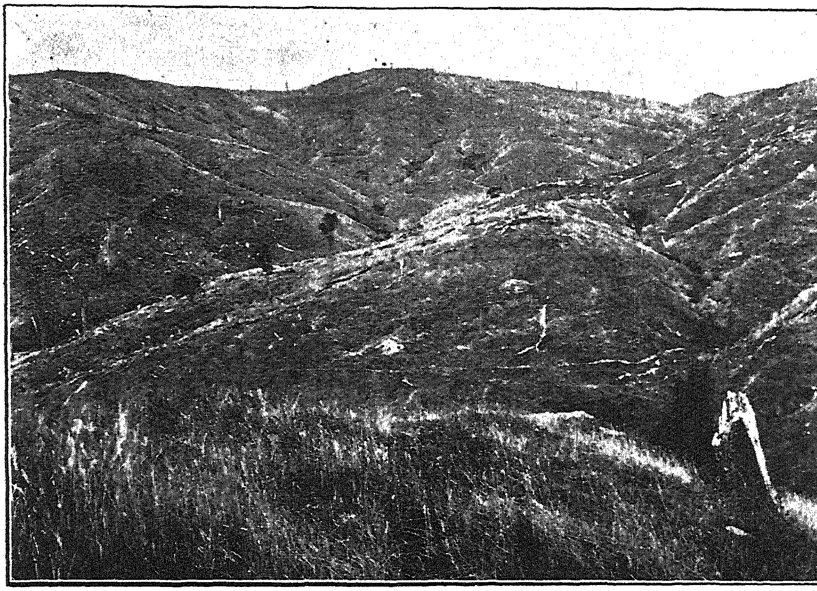


FIG. 51. THIRD DEVELOPMENT: PRIMARY BURN TO PERMANENT GRASSLAND OF A NATURE DIFFERENT FROM THAT SOWN OR INTENDED.

Danthonia and brown-top turf mainly; on hill country in the Wairarapa.

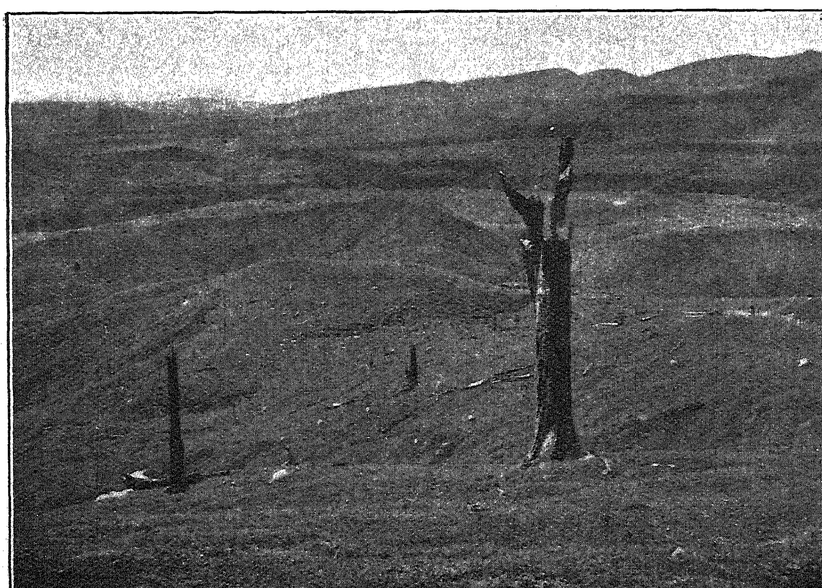


FIG. 52. FOURTH DEVELOPMENT: PRIMARY BURN TO PERMANENT GRASSLAND, RETAINING LARGELY THE ORIGINAL SPECIES SOWN.

Area in southern Hawke's Bay.

[*Photos by E. B. Levy.*

fertility cannot be economically built up and conditions cannot be eased, inferior, hardier grasses are the only alternative for hill country.

It will be patent in this series of articles that the writer lays a great deal of stress upon management—upon the type of management, upon the ability to maintain fertility, upon the ability either to spell or to crush at set periods, and upon the class of stock grazed on the pasture. Each has an important bearing on just which grasses and clovers or what set of secondary-growth weeds are to become the dominants on the particular country. No species of grasses and clovers, no application of artificial manures, are of any avail without carefully managed stock. Thousands of acres of hill country have been burnt and sown, but owing to the inability to stock at the right

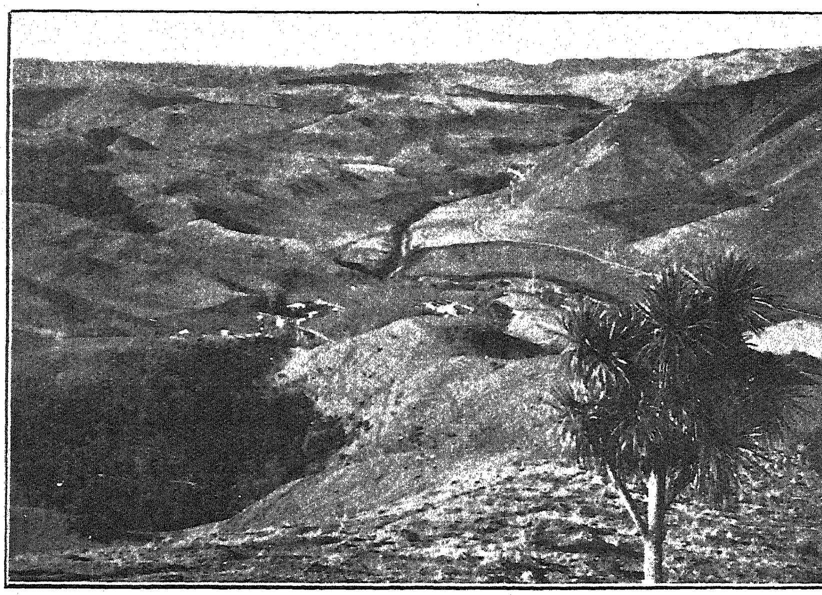


FIG. 53. PART OF RANGITIKEI COUNTY (MOHANGA) WHERE DANTHONIA IS COMING INTO COUNTRY THAT SHOULD STILL BE CARRYING A LARGE PROPORTION OF RYE-GRASS. [*Photo by E. B. Levy.*

time have reverted once more to fern and scrub. It were infinitely better that the money had never been spent on seed under such management, for not only is there the direct financial waste, but there also follows loss of heart in the worker and loss of confidence in the country by the settler. The wetter the climate the truer becomes this truth—that grass-seed sowing or manurial top-dressing go for nought without the judicious management of stock. In drier districts where burning can be regularly carried out the stocking factor is not so important, for here the removal of the shade of secondary growth is easily accomplished by fire before the growth gets sufficiently dense to kill out the grass. It must be borne in mind that the ultimate value of stock, particularly cattle, is to crush out secondary growth, so that plenty of light may reach to the ground-surface to give strength and life to the pasture.

GRASSES AND CLOVERS USED IN HILL PASTURES.

There are in the main a dozen or so grasses and clovers that are most commonly used in hill-country pastures—namely, perennial rye-grass, cocksfoot, crested dogstail, Poa pratensis, paspalum, brown-top, Danthonia pilosa, ratstail, white clover, Lotus major, suckling-clover, English trefoil, subterranean clover, Lotus hispidus, and yarrow. On really first-class forest country certain additional species may be used in small quantities, these being meadow-foxtail, Poa trivialis, timothy, alsike, and red clover. From what has been said it will be seen that according to conditions of soil, aspect, and management so will one or more of these species predominate. In no hill country do we find the whole of these species equally mingled together, although on any one tract each may dominate over a more or less localized area within that tract of country. In the past the farmer in choosing species for his hill country has been very apt to choose those species that he would like to see present on his farm, rather than those that the country can support. Cheapness of seeding, bulkiness for sowing, rapidity of establishment, and early production have been big factors also in influencing the choice of species.

It is hoped that the following short account of the different species for hill country will add somewhat to the farmer's knowledge, and will thus enable him to spend money to better advantage in the buying of seed.

(1.) **Perennial Rye-grass** (*Lolium perenne*).

In the early days of the breaking-in of hill country, in the North Island particularly, perennial rye-grass as a dominant in the mixture was almost universal. In the mid-west back-country the argument waged not about whether the country should be sown with hardier grasses, but whether it should be sown with rye-grass or cocksfoot, many settlers arguing that the country was too good for cocksfoot. Any advocate of the hardier grasses, such as danthonia, fifteen to twenty years ago in Taranaki or in the King-country would most probably have been regarded as insane and a menace to the district.

Perennial rye-grass is the farmer's ideal in many respects. The seed is cheap and easily procured; it is bulky and nice and easy to sow; it does not cling to the sacks or clothes of the sower; it is easily spread, being visible on the ground, and quite a good area of ground can be covered at each cast; the seed germinates readily, and its establishment is rapid and certain, and quite early there is a good growth of palatable herbage. The great failing of rye-grass, however, is that it does not hold, excepting under very special conditions (Figs. 54 and 55).

The strong early growth of rye-grass on hill country is due to the plentiful supply of plant-food present in the humus of the forest-floor and ash of the primary burn. As soon as this supply becomes exhausted the rye-grass dwindles and "goes out" as far as being a feed-producer is concerned. This weakening of rye-grass and subsequent opening-up of the pasture sward is the first stage of deterioration in hill-country pastures.

FIG. 54. FAILURE OF RYE-GRASS ON HARD KNOLL ON PRIMARY BURN FOUR YEARS OLD.

Hard fern and weeds are here taking possession.

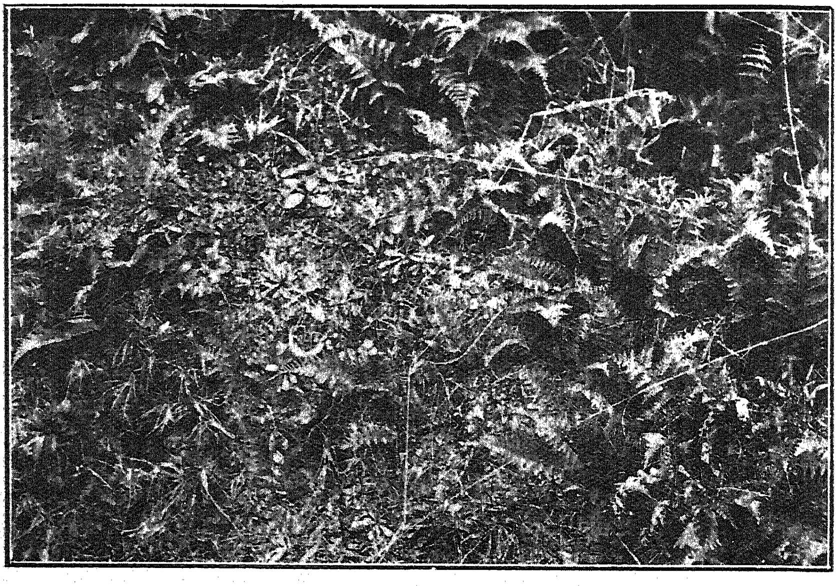


FIG. 55. FAILURE OF RYE-GRASS ON SECONDARY BURN.

Close view on a hard-fern burn, showing the ground run largely to catsear, and hard fern rapidly spreading again. [*Photos by E. B. Levy.*

For perennial rye-grass to thrive there must be a plentiful supply of available plant-food in the soil; hence the range of rye-grass on any hill-country farm is limited to those areas of high soil-fertility. The more general this high state of fertility the more general will rye-grass be in the pasture. Conversely, the more restricted these areas of high soil-fertility the more restricted becomes the rye-grass.

An examination of the pastures on any hill country will bear out this statement, and will show very clearly the position rye-grass occupies at the present time on old grassed hill country. We may start with the holding-paddock (Fig. 56), which, as will be commonly agreed, is generally the most highly fertile piece of land the hill-country farmer possesses, fertility from the hills being conveyed there and deposited by sheep and other stock concentrated there at different times. The following point analysis of a holding-paddock twenty-five years old, on the farm of Mr. A. Coxhead, Whangamomona, tells clearly and accurately what the predominant grass is:—

Point Analysis, Small Holding-paddock, A. Coxhead, Whangamomona, 16/5/25.

	Percentage of Ground-area occupied.
Bare ground	1·2
Perennial rye-grass	48·8
Cocksfoot	16·0
White clover	12·0
Poa trivialis	6·0
Poa pratensis	2·5
Suckling-clover	1·6
Yorkshire fog	2·0
Brown-top	0·4
Danthonia pilosa	0·2
Yarrow	1·0
Poa annua	1·3
Weeds	7·0

In this analysis it will be seen that perennial rye-grass forms just about half the total cover, and this species, together with other first-class grasses and clovers, comprises some 85 per cent. of the entire sward. Bare ground occupies only a little over 1 per cent.

If now we go from this holding-paddock through the fence shown in Fig. 56 we come to a larger holding-paddock where, owing to a lesser concentration of stock, the fertility is not maintained to so high a standard. The state of this pasture is shown by the following point analysis:—

Point Analysis, Large Holding-paddock, A. Coxhead, Whangamomona, 5/6/25.

	Percentage of Ground-area occupied.
Bare ground	10·0
Perennial rye-grass	24·0
Cocksfoot	14·3
Poa pratensis	10·0
Yorkshire fog	9·7
Poa trivialis	7·6
Suckling-clover	6·0
White clover	1·0
Crested dogstail	0·3
Danthonia pilosa	0·3
Poa annua	1·0
Timothy	0·5
Weeds	15·3

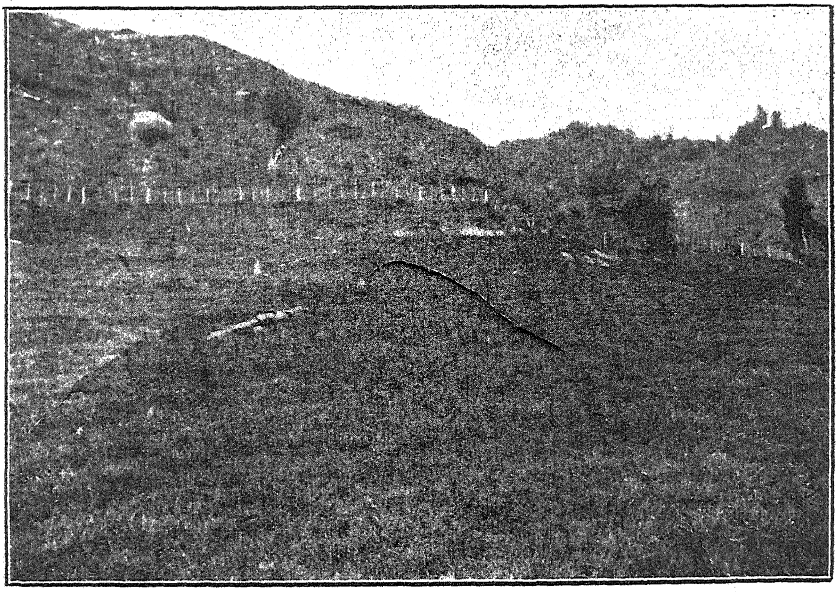


FIG. 56. HOLDING-PADDOCKS ON FARM OF A. COXHEAD, WHANGAMOMONA.

Small paddock is shown in foreground, and large paddock through fence in background.

FIG. 57. STOCK-TRACK ON HILLSIDE.

On left, weak, open turf; on right, brown-top mainly; in centre, rye-grass dominant on the track itself. [*Photos by E. B. Levy.*

Here, then, we see under a lower state of fertility a reduction in the amount of perennial rye-grass, and a noticeable increase in the amount of weeds and bare ground.

Again, tracks on hillsides are usually more fertile than the general slope, and along such tracks rye-grass usually predominates irrespective of what grass is growing on the general slope (Fig. 57). Consolidation and treading by stock favour extremely the growth and persistence of rye-grass, but it must be borne in mind that these factors are generally accompanied by a fertility-increase due to the manure deposited while the treading and consolidation processes are going on. Congregating-places for stock (Fig. 58), foothill slopes and ridges where one finds stock camps, are also generally fertile, and here, again, rye-grass becomes a dominant. These stock camps on ridges, where the soil is usually scanty, show that with the maintenance of a high surface-soil fertility there is little need for depth of soil to ensure persistence and a satisfactory growth of rye-grass. Fig. 59 shows perennial rye-grass growing vigorously on not more than 1 in. depth of soil overlying a hard sandstone outcrop. This portion of the ridge was used as a sheep camp.

On the foothills and easier slopes one can generally find a fair sprinkling of rye-grass. In certain parts of the better hill country in Rangitikei and Hawke's Bay it may even extend a good distance up the slopes, its extent always being defined, however, by the limits of richer soils.

In the Taranaki back-country, wherever the surface soil has become depleted, one finds the following position in regard to perennial rye-grass in the pasture :—

Point Analyses, Old Pastures, on General Slope where Fertility has become considerably depleted.

	Easy Foothills, J. Ostler, Kohuratahi, 20/6/25. Percentage of Ground-area occupied.	General Slope, C. Carter, Tahora, 8/5/25. Percentage of Ground-area occupied.
Bare ground	16·5	17·2
Perennial rye-grass	4·4	3·9
Cocksfoot	9·9	8·4
Poa pratensis	10·4	5·0
White clover	4·4	1·6
Yorkshire fog	17·2	7·7
Catsear	16·1	20·2
Suckling-clover	7·6	2·8
Sweet vernal	..	16·1
Crested dogstail	0·2	..
Timothy	0·2	0·2
Selfheal	9·7	5·4
Danthonia pilosa	..	0·8
Chewings fescue	..	1·1
Other weeds	3·4	10·0

As a feed-producing constituent in the above pastures it can be said that rye-grass is of very little value. Analyses made on harder and poorer slopes than these show even a greater decrease in the amount of rye-grass present; but the analyses given are sufficient to show that under poor, hard soil conditions rye-grass after a few years dwindles to insignificance as a feed-producer in the pasture.

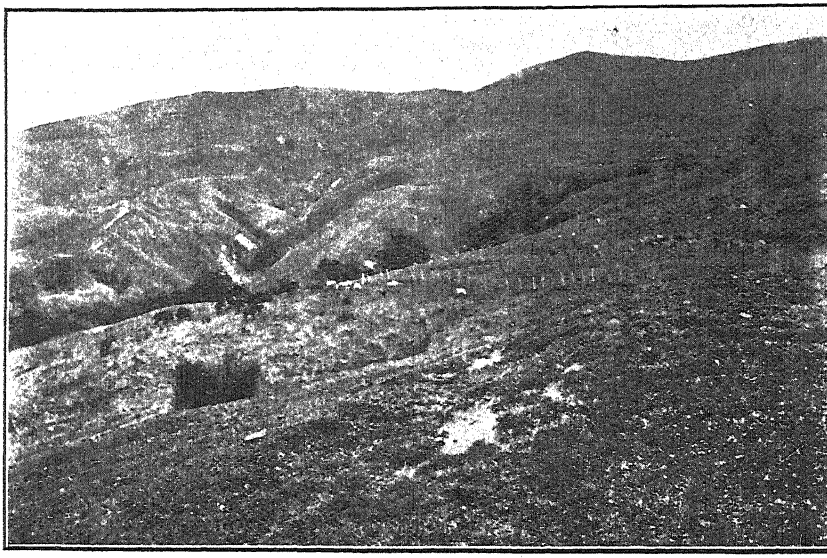


FIG. 58. CONGREGATING-PLACE FOR STOCK ON FAIRLY EASY FOOTHILL, WITH RYE-GRASS LARGELY IN EVIDENCE.

The general slope is mainly danthonia and New Zealand rice-grass. Location, Wairoa, Hawke's Bay.

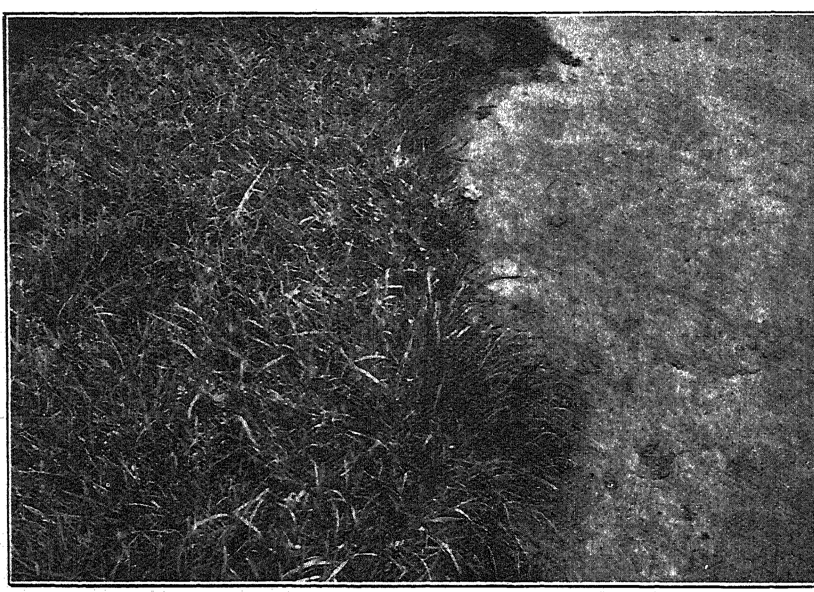


FIG. 59. PERENNIAL RYE-GRASS GROWING VIGOROUSLY ON SOIL NOT MORE THAN 1 IN. DEEP.

The surface fertility here is extremely high, the area being used by sheep as a camp. On right is the bare sandstone outcrop, which underlies also the rye-grass sward.

[*Photos by E. B. Levy.*

It will be seen, then, that perennial rye-grass persists and grows strongly on hill country only where the soil is naturally very fertile or where the soil-fertility has been maintained at a high standard through the influence of stock. If more stock can be maintained (not starved) on an area by inbrought stock-foods or by promoting a general higher-production pasture by top-dressing with artificial manures, then would be found an enlargement of stock camps, more consolidation and treading, more tracking of the slopes, and hence a greater proportion of rye-grass throughout the pasture (Figs. 60 and 61).

A surprising feature of grassland is the manner in which species once sown and established persist in the pasture sward, even under a very low state of soil-fertility and in competition with low-production, hardy pasture-plants. If one refers to the pasture analyses on page 305 it will be noted that after twenty-five years, under a very much reduced fertility, there is still a small percentage of the better elements persisting as vestiges in the sward. Perennial rye-grass is noteworthy in this respect, and upon this fact depends the return of rye-grass in pastures once fertility is sufficiently increased.

PERENNIAL RYE-GRASS UNDER SHADY CONDITIONS.

Perennial rye-grass will not endure shade, and as a competitor against rank cocksfoot or secondary growth it is an utter failure. With regard to the hill country, the inability of rye-grass to endure shade limits its usefulness to some extent, but with secondary growth predominating it generally means that soil conditions have become too hard for rye-grass to thrive well. Strong-growing rye-grass, reasonably well stocked, will compete with any secondary growth, but once it weakens and secondary growth puts in an appearance it is soon subdued by the shade such growth casts.

PERENNIAL RYE-GRASS IN PRIMARY AND SECONDARY BURNS.

From what has been said it will be seen that perennial rye-grass has its limits and shortcomings on hill country, and the question is to what extent should it be sown on primary and secondary burns.

There is no argument against the use of perennial rye-grass on the primary burn (Fig. 62). The soil-fertility is present, and the early feed secured from the rye-grass goes a long way in the first year or two towards paying the felling and seeding expenses of the burn. Its rapid growth enables an early stocking of the burn, which is necessary in the control of secondary growth, and a good sward of grass from the outset certainly limits to some extent the very large growth of Scotch thistle now almost universal on primary forest burns. On primary burns of the Taranaki back-country, at any rate, one has to be careful not to let rye-grass dominate the mixture to the exclusion of some at least of the finer seeds and hardier grasses. On the average slopes 6 lb. to 8 lb. per acre of perennial rye-grass in the mixture is sufficient.

With regard to secondary burns, it is just a toss-up whether perennial rye-grass should be included or not. If sown in the early autumn

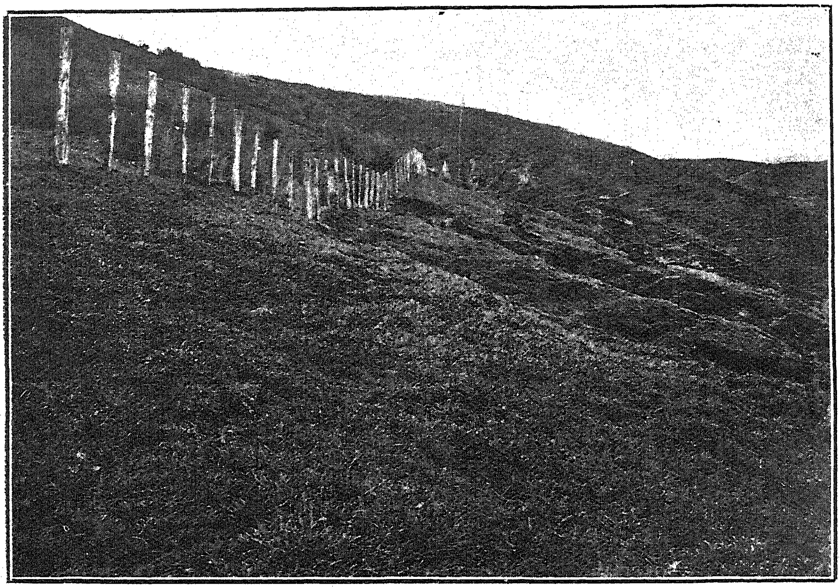


FIG. 60. HILLSIDE AT WAIROA, USED AS A RUN-OFF PADDOCK FROM THE FLAT BELOW (NOT SHOWN).

Fertility of the flat transferred by stock raised the fertility of the hills sufficiently to promote a strong growth of rye-grass.

FIG. 61. CLOSE VIEW OF TURF JUST BEYOND FENCE ON LEFT OF FIG. 60, WHERE NO FERTILITY-INCREASE HAS BEEN EFFECTED.

The rye-grass is extremely stunted and weeds are becoming dominant.

[*Photos by E. B. Levy.*

certainly rye-grass does give a quick bite during the following winter, particularly on heavy bracken and heavy manuka burns. The guiding principle, the writer thinks, in the use of perennial rye-grass in secondary burns is whether the rye-grass in the first two years will give sufficient feed to pay for its inclusion in the mixture, bearing in mind always that unless some system to increase and maintain fertility be adopted the perennial rye-grass is not going to remain an important permanent element. A thing that is temporary must recoup itself rapidly to justify its inclusion or use. A species that is going to remain permanently need not pay for its inclusion in the first year or so. From analyses made of sowings on secondary burns at Whangamomona it would appear that perennial rye-grass in the first year was about fourth on the list of species as far as cheapness of cover was

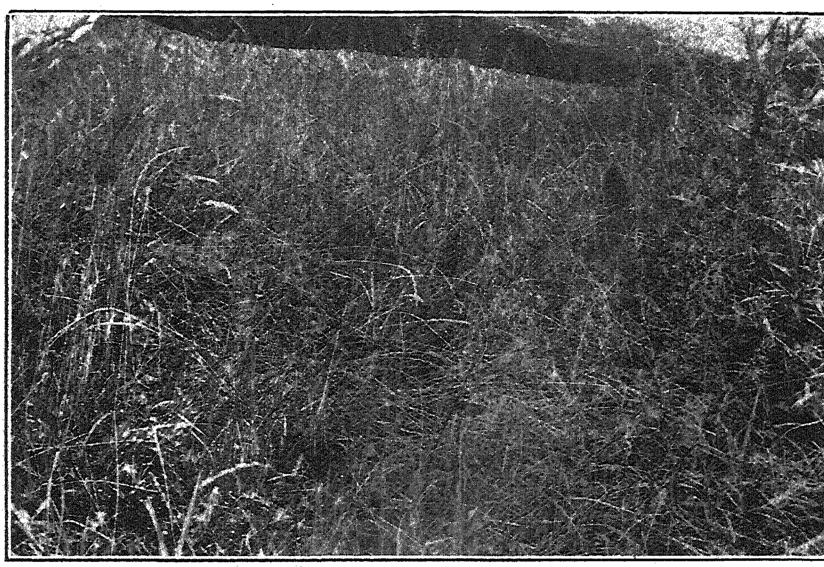


FIG. 62. PERENNIAL RYE-GRASS AS A DOMINANT ON A PRIMARY BURN.
Farm of Murphy Bros., Aotuhia, Whangamomona County.
[*Photo by E. B. Levy.*

concerned. In mixtures for secondary-growth burns it is imperative that the seeding should not be expensive. The cheapening of the sowing by using mainly perennial rye-grass is a disastrous course to adopt; in fact, the inclusion of perennial rye - grass should only be considered after the settler has available sufficient money to pay for the inclusion in sufficient quantities of the more important elements of the mixture. Perennial rye-grass, therefore, cannot be regarded as an integral part of mixtures for the sowing of secondary burns, but its inclusion in the mixture may enable a higher winter carrying of stock on the new burn for one season. Whether or not this early production and winter stocking of a new secondary burn is advisable still remains to be proved; 2 lb. to 4 lb. of perennial rye-grass per acre is sufficient to include in the mixture for any secondary burn.

SUMMARY.

From the foregoing it will be seen that perennial rye-grass on the hill country has sadly declined from major rank during the past twenty-five years, and that unless steps are taken to replace the annual loss of fertility that goes off the farm in wool, mutton, lamb, milk, and beef the dwindling process of rye-grass will go on—more and more openings in the pasture affording easy ingress for weeds or other species of grasses. The country which carried rye-grass for a few years only should see it no more, the expense of raising that soil to rye-grass standard probably being too high. The soil, however, which has carried rye-grass for the last twenty-five years or so, but which is now running

FIG. 63. PASTURE TWENTY-FIVE YEARS OLD, IN THE APITI DISTRICT, SHOWING SPINDLY RYE-GRASS AND WEEDS (CATSEAR MAINLY) INVADING THE WEAK TURF.

Liberal top-dressing would bring this country back to rye-grass.

[*Photo by E. B. Levy.*

to inferior grasses or weeds (Fig. 63), should be top-dressed by hand to win it back once more to rye-grass. Strong-growing perennial rye-grass cannot be surpassed for production, and the more of it the farmer keeps in his pastures the more credit is due to his farm-management. This, however, will not be secured by simply sowing: it must be well managed and liberally fed.

NOTE.—Point analyses quoted in this article were made by the writer's assistant, Mr. E. A. Madden

(Series to be continued.)

Noxious-weeds Orders.—The Wairoa County Council has declared foxglove, Bathurst burr, and variegated thistle to be noxious weeds within that county.

DETERRENT SPRAYS FOR PEAR-MIDGE.

FURTHER EXPERIMENTS AT HENDERSON.

R. H. MAKGILL, Henderson, Auckland.

IN the *Journal* for April, 1925, the writer gave some account of the use of nicotine with an oil carrier as a spray intended to deter the female midge from depositing its eggs in the young leaves of the pear. Further experiments were conducted in the spring and early summer of 1925. The results, however, are somewhat obscured by the fact that the midge this season failed to appear at the usual time. Previously midges have been caught between 1st and 6th October. In 1925 none was detected till 11th October,* and the first signs of infestation of pear-leaves were not evident till the 18th, whereas in former years these signs showed themselves from the 10th to the 13th of that month. Possibly this was the result of the cold weather and frequent rain experienced during September. The result was satisfactory from the pear-growers' point of view, since this delay enabled varieties such as Beurré Bosc and Bon Chretien to set their fruit and develop a fair covering of leaves before the midge got to work. Larger crops and better growth than in any year since the midge became prevalent was the result even on trees which received no deterrent sprays, and this was the experience of most orchardists in the Henderson district. It is therefore necessary to exercise caution in drawing conclusions from the apparent results of the sprays tested.

European observers have reported satisfactory results from the use of naphthalene as a means of keeping insects off plants, so the writer decided this year to give it a trial. In a series of articles in the *Journal of Pomology* R. M. Woodman describes experiments testing various methods of making emulsions and suspensions. In that publication for January, 1925, he reports most favourably upon gelatine (or size) as a means of suspending solids in spray solutions, and mentions that in wet weather the leaf-surfaces sprayed with gelatine were not washed clear of spray, but became sticky, so that the suspended solids were more adherent. As the sprays tried in previous years against midge seemed to lose power after wet weather it was also decided to test the value of glue (size) as a suspensory agent. The following are the details of the experiments :—

NICOTINE WITH OIL SPREADER.

In the previous article mention was made of a spray with Black Leaf 40, 1 in 800 parts, and a mineral oil (sold as Olene) as the spreader, in a strength of 2 per cent.

In 1925 ordinary spraying-oil at a strength of 1½ per cent. was substituted for the Olene, and this spray was applied on 4th October

* A simple method of detecting this midge is to examine the contents of spiders' webs in the trees. By using a piece of glass smeared with glycerine these webs can be collected and the captured insects examined.

to a block of eighteen three-year-old pears of mixed varieties. As a result a certain amount of leaf-scorch was produced, especially in some varieties, and the use of oil was not repeated.

NICOTINE WITH SIZE AS SUSPENSOR.

In his experiments at the Horticultural Research Station, Cambridge University, Woodman found that gelatine in a proportion of 3 lb. to 100 gallons of water was an effective suspensory agent for arsenate of lead. This proportion was therefore adopted by the writer, ordinary painter's size being used instead of gelatine. Nicotine sulphate, in the form of Black Leaf in the ratio 1 in 800, was stirred into this glue solution, some soap-powder—½ lb. in 100 gallons—being added owing to the hardness of the water from the deep bore well supplying the orchard. This mixture was applied to the block of eighteen three-year-old pears already mentioned and to four well-grown Beurré Bosc pear-trees on the following dates: 14th and 25th October and 1st and 7th November. Thereafter naphthalene was added to the mixture, as will be described in a subsequent paragraph, but prior to this change the nicotine-glue spray proved effective in reducing the attacks of the midge. Thus on 1st November, while the unsprayed trees throughout the orchard showed midge-infestation on practically all the growing tips, with the usual resulting blackening of the infected leaves, the young three-year-old trees were practically free, perhaps five or six curled leaves on each tree being the only evidence that midge was present. From the date on which these few infected leaves began to blacken it was possible to deduce that the eggs were laid about 23rd October. Had the original intention to spray every seven days during October been carried out it is possible that even this slight attack would have been avoided. Probably the effects of the spraying began to wear off towards the end of the eleven days which intervened between the spraying on 14th October and that on 25th October.

By 14th November, when the composition of the spray was altered, these young trees still showed a satisfactory freedom from midge-infestation, with the exception of one variety (L'Inconnue) on which a fair number of affected leaves were found—not, however, sufficient to check the growth of the new shoots.

In regard to the adult Beurré Bosc trees, the results of spraying were not so evident. Most of the young shoots showed a certain amount of infestation by 14th November, but it was certainly less than on the trees which had not been sprayed. These trees were too large to be very effectively treated by the hand-pump with which the experimental spray-mixtures were applied. Possibly the use of a power-spray machine would have given better results. One satisfactory feature, however, was the noticeable reduction in damage from bronze-beetle evident on all the trees, both young and adult, to which the nicotine-glue spray was applied. Even the tips of the tallest trees showed few ragged damaged leaves, and on the smaller, more accessible trees this freedom was more pronounced.

APPLICATIONS OF NAPHTHALENE.

Naphthalene appears to have no injurious action on plants. It has been applied in various ways by European observers to drive off insects. Taschenberg advocates hanging rags soaked in naphthalene

in the branches of apple-trees to keep away codlin-moth. A dusting-powder formed of one part naphthalene to nine parts of sulphur is used to prevent the female cochylis from laying its eggs on the vine. Mixed with lime, it is applied to the soil to destroy ants, crickets, cockchafers, and so on.

To test its effect on the pear-midge small muslin bags filled with naphthalene were hung in the branches of two P. Barry trees, and it was found that in an area about 8 in. or 10 in. from the bags no leaves were attacked by the midge. The only form in which the writer was able to get naphthalene was the ordinary "moth-ball." These had to be crushed to a fine powder in carrying out the various trials. For the future, arrangements have been made with a firm importing chemicals to obtain it in finely powdered form.

It was somewhat difficult to determine the most suitable method of applying the naphthalene, which is insoluble in water and not readily soluble in alcohol or paraffin.

NAPHTHALENE AND SPRAYING-OIL.

Kerosene and spraying-oil dissolved naphthalene in a proportion of about ½ lb. to the gallon, but for a summer spray not more than 1½ per cent. of spraying-oil can be used with safety. Thus the proportion of naphthalene reaching the leaves is extremely small if such a solution be used. It was applied to fifteen young P. Barry pears and two fully grown Bon Chretiens on 4th October, and again on 14th October. It was so far effective that by 25th October, when unsprayed trees showed fairly severe infestation by midge, these P. Barrys were practically free, and there was little to be seen on the Bon Chretiens. However, there was a noticeable amount of leaf-scorch from even so small a proportion as 1½ per cent. of the oil, so this method of carrying naphthalene was abandoned.

NAPHTHALENE AND SULPHUR DUSTING.

Powdered naphthalene, being somewhat inclined to cake, is not a very suitable material for dusting unless mixed with some light non-caking powder. Sulphur-flour was found to be suitable, and as such a mixture has been used in Europe it was tried on three young P. Barry pears, the proportion being one part of naphthalene to two parts of sulphur. To ensure adhesion of the dust the trees were sprayed before dusting with a solution of 3 lb. of size in 100 gallons of water. This was applied on 14th and 25th October, and 1st and 7th November.

On the latter date the dusted trees were practically free from midge-infection, and afforded a marked contrast to some Beurré Diel trees alongside them which had been treated in another manner, to be described presently. It is probable that the naphthalene was the most active agent in keeping off the midge, but sulphur is also to some extent a deterrent to insects. However, by the first week in November it was noticed that the dusting was having a deleterious action on the leaves, which were dark in colour, somewhat dry and leathery, with a tendency to curl at the edges. It is known that in sulphuring vines there is a danger of scorching the leaves if it is done in hot sun, and probably this was what took place with the pear-leaves. The method was therefore abandoned.

NAPHTHALENE POWDER SUSPENDED IN SIZE SOLUTION.

It was found that 10 gallons of a solution containing 0·3 lb. of size would carry in suspension 1 lb. of finely powdered naphthalene. It required frequent stirring, but if this were done there was little choking of the spray-nozzle. It was decided that, since both naphthalene and nicotine had power to hamper the activities of the midge, these two substances should be combined. Therefore from 14th November all sprayings were done with a mixture containing, in 10 gallons, 5 oz. size, 2 oz. (1 in 800) Black Leaf 40 and 1 lb. naphthalene powder. A small quantity of soap-powder was added also, as already described when dealing with the nicotine spray.

This was applied to the young pears hitherto treated with nicotine alone, to the P. Barry pears hitherto treated with dusting or with naphthalene in oil, and to four adult Beurré Boscs and two adult Bon Chretiens. The dates of spraying thus were 14th, 21st, and 28th November, and 4th, 12th, 19th, and 25th December. It was found that this spray had no harmful action on the leaves, and the P. Barry trees which had been checked by the dusting put out healthy new growth. Even so delicate a foliage as that of the peach-tree was not affected by this mixture.

For a time this spray was effective against the attacks of pear-midge. On 28th November the untreated pear-trees throughout the orchard showed widespread infestation, yet the eighteen young pears which had been under treatment throughout the spring and the P. Barry trees had a new growth of from 2 ft. to 4 ft., well clad with undamaged leaves. A few curled leaves were to be found, but not enough to affect the growth.

With the adult trees the benefit was not so marked. They had a good covering of leaves and a satisfactory setting of fruit, but owing to the late appearance of the midge most of the last trees which had not been treated also showed these features. The foliage on the sprayed trees was on the whole better than the average, but was not better than the best of the unsprayed ones of the same varieties. It was satisfactory, however, to find that the setting of fruit was good, from which one could conclude that the spraying had not affected the work of the bees in pollinating.

With the young trees in so satisfactory a condition at the end of November it was disappointing to find that during the first week in December a heavy infestation developed, just as had been the case in previous years. It may be that towards the end of November, when the flights of midge are continuous, the available young leaves throughout the orchard were mostly already infested, and that the female midges were compelled to use the sprayed trees, repugnant though they may be. In the past season there were no specially heavy rains about 27th November (the probable date of infestation) to wash off the spray, nor very hot sun to cause evaporation of the nicotine and naphthalene. The failure of immunity would seem to be due to greater activity on the part of the midge at the period in question.

After 4th December, despite weekly spraying, little new growth formed on the trees till the autumn, when the midge was becoming quiescent. The sprayings were not continued after 25th December.

CHLORIDE OF LIME AS A DETERRENT.

Chloride of lime—or, rather, bleaching-powder—by reason of its property of giving off acrid fumes of hypochlorous acid, is so offensive a substance that it was thought that it might be effective against the midge. Nine well-grown Beurré Diel pear-trees (a variety very readily attacked by the midge) were selected for trial. The bleaching-powder was applied in three ways: (1) Sprayed in a solution containing in 10 gallons water, ½ lb. chloride of lime, and 5 oz. size as a carrier; (2) dusted round the roots of the trees; (3) hung in trays in the branches of the trees.

These applications were made to various trees on 4th and 14th October. The spray did no damage to the leaves, but the dust, where it happened to touch the foliage, caused immediate death of the leaf. It also destroyed all weeds growing under the trees, and later was used with some success in checking the growth of blackberries. However, bleaching-powder proved quite useless as a deterrent of the midge. Infested leaves were found close up against the trays hung in the branches, where the odour of chlorine must have been very strong. On 18th October, four days after the second application, the effects of the midge attacks were evident—indeed, these Beurré Diels were the first trees in the orchard to be infested, and by 25th October, when the trees treated with nicotine and with naphthalene were quite free, these Diels were widely and severely attacked. The use of chloride of lime was therefore stopped.

CONCLUSIONS.

From the results of the experiments in 1925 and previous years the writer is satisfied—

(1.) That nicotine and naphthalene each are effective deterrents of midge-infestation during October and November.

(2.) That towards the end of November and in December the activities of the midge are such that these deterrents become of little use.

(3.) Size forms an excellent carrier for nicotine and naphthalene, and these substances can be combined in a spray which will not damage foliage.

(4.) There is a risk of leaf-scorch from the use of spraying-oil in the spring even at so low a proportion as 1½ per cent.

(5.) Repeated dusting with sulphur has a harmful effect on the leaves of the pear.

It seems possible that by the use of the nicotine and naphthalene spray, applied weekly during October, bearing trees may have a chance to establish a good crop of leaves and set their fruit. In 1925 this occurred because the development of the midge was delayed by climatic conditions. One may hope to secure a like postponement of attack by artificial means, and further experiments will be undertaken in this direction. With young pear-trees, by carrying on the spraying throughout November, a fair growth may be established before the midge becomes too active; and although the injury done thereafter in the summer months must be a serious check to the growing tree, at least there will result a degree of progress not to be found in unsprayed trees.

THE CONTROL OF WEEDS.

2. LOSSES OCCASIONED IN PRODUCTION.

A. H. COCKAYNE, Director of the Fields Division.

THE annual monetary losses occasioned by weeds, from the two standpoints of direct expenditure incurred in their suppression and actual loss in production through their presence, amount to a sum far in excess of that currently realized by farmers. There is little doubt that weeds represent, through their influence on the restriction of agricultural production, a loss not less than that experienced through the combined effects of animal and plant diseases. To my mind, in fact, weeds represent, in checking agricultural expansion, the greatest single factor against which the farmer has to contend.

It is not to be expected that it will ever be possible on a practical basis to bring down weed-damage to negligible proportions. All that can be hoped for is that damage which practice shows to be avoidable on an economic basis should be reduced to a minimum. Such is not being done at the present time, and losses from weeds are tending to rise rather than fall, this being without doubt largely due to farmers failing to realize at their true significance the real principles that must govern weed-control in a country where land-acreage is high and rural population low.

Although weeds, especially when they have the legal appellation "noxious" attached to them, are a perennial source of discussion among farmers, it appears strange that there should be so little definite information available as to the monetary damage they occasion, and stranger still is the fact that many plants on the control of which immense sums are being and have been spent are rarely viewed as having any serious potentialities.

To the farmer weeds are of two types. Firstly are those that are causing him personal damage by visibly lowering the production of his land, or visibly increasing his costs of production by direct expenditure; or, again, which have made him adopt cropping and stocking programmes essentially different to those satisfactory were the weeds not present. Secondly are those that may or may not be on his property, but possess a "reputation" as being serious and likely to grievously reduce the selling-value of his land. Very frequently the weeds the farmer views as really serious are those with a reputation, rather than those that are really at the moment causing him appreciable loss. Expenditure quite willingly incurred in the pulling of foxglove on country threatened with complete second-growth invasion, and failure to adopt reasonable methods of second-growth control, is a typical example of reputation rather than actual seriousness governing the weed question.

It is contended that the seriousness of a weed should be viewed from two standpoints — (1) from a consideration of the actual loss and expenditure it has and is occasioning, and (2) from a consideration of its future possibilities in the light of our present known methods of management and control. In general, it can be said that far more stress is laid by farmers on the future possibilities of a weed than

what it is actually doing. Frequently the fact that certain areas, under probably very inefficient management, are infested with some special weed is used as proving that unless the most stringent methods for complete eradication are taken it will overrun and ruin the whole country. The agricultural history of New Zealand has been punctuated with weed scares: Scotch thistle, Californian thistle, sweetbrier, gorse, ragwort, foxglove, and many others have been heralded and acclaimed for a space as the future destroyers of the land.

To-day blackberry holds undisputed sway as the accepted noxious weed *par excellence*. At the recent New Zealand Institute Science Congress at Dunedin I had the temerity to suggest that there were other weeds which were occasioning far greater loss than blackberry. The idea that one would not subscribe whole-heartedly to the contention that blackberry, unless completely eradicated, would turn the whole of New Zealand into an impenetrable blackberry thicket aroused quite widespread indignation in various quarters. Serious as the position is in certain districts of New Zealand through the presence of blackberry, it must be unhesitatingly asserted by any one who has given any real attention to the subject that its menace is not as serious as popular clamour would lead one to believe, provided reasonable steps are taken to protect by proper management the clean and comparatively clean grass areas.

At the Dunedin meeting I claimed that on our grasslands ordinary bracken and hard fern had and were occasioning far greater losses than had blackberry. With this opinion all must agree when it is pointed out that at the present time in both the North and the South Islands there are quite one million acres of ground that have become fern-dominant which when clean were capable of carrying a sheep to the acre. From recent statistics it would appear that the product of an average sheep per year can be put down at £1 6s. Taking this figure as a basis, fern has the unenviable distinction of reducing the production of the country by not far short of one and a half million sterling per year. Certainly blackberry, bad as it undoubtedly is, cannot be justly claimed as causing such very heavy loss. I fully realize that it will be at once said that fern can be controlled on an economic basis, whereas blackberry cannot be thus controlled where the land is of comparatively low value and has become badly infested. The fact, however, that fern, a controllable weed, causes such widespread loss does not alter the fact that, measured in loss of production, it ranks as probably the worst weed of this country.

So far as actual direct expenditure is concerned, I would be inclined to place the members of the twitch family as our most expensive weeds. On a conservative estimate at least three thousand horses, additional to those necessary for normal cultivation, have to be kept for the control of those underground-stemmed plants that come under the farmer's category of twitch. This means that these weeds are causing an annual expenditure of from £150,000 to £200,000 over and above that necessary were they absent. Even with this large annual expenditure definitely increasing the costs of actual production to a very appreciable amount, twitch still remains as a serious reducer of crop-production. It is interesting to note that neither fern (one of the major features of second-growth invasion) nor

the twitches (as the worst weeds of arable land) come within the legal interpretation of "noxious" weeds, and this only indicates that a rather erroneous perspective is given to the weed problem by confining our conception of noxious weeds to those that have been declared so by legislative enactment or local-body order.

In the absence of definite and accurate statistics it is quite impossible to put down any reliable figure as to the total loss in production caused by weeds, but I hazard the estimate that a leakage of quite 10 per cent. flows through their channels. As the value of our total agricultural production cannot be far short of seventy millions sterling such an estimate means an annual loss of seven millions per year. As already stated, it is not to be expected that weed loss can be brought to negligible proportions even by the most skilful of farm-management, but the losses estimated are sufficiently large to emphasize the fact that the most efficient management possible should be adopted to reduce, so far as is economically sound, the undue toll now being paid by our farmers.

A most serious feature of the weed question on our grasslands is that a very considerable area of the land under occupation is made very little use of, being comparatively waste land, but which the holders hope sooner or later to bring into profitable production so soon as the better parts of their holdings are on a stable and permanently productive basis. At the present time, owing to the very small returns derived from such land, it cannot justify any appreciable recurrent expenditure in weed-control. In consequence such areas soon become covered by nature with the vegetation most suited to the soil, aspect, and climatic conditions. In most cases stocking is only irregularly carried out, and when weeds—that are afterwards extremely expensive to control—obtain possession there is the chance that these areas may never pay to break in and will permanently remain waste land. Weeds such as gorse and blackberry are particularly serious on such land, as when they obtain full possession no stocking can be carried out unless at almost ruinous expenditure, and in consequence such areas tend to become not only valueless but a menace by the invasion of neighbouring land of moderate producing-value.

Under the present system of land-valuation farms with considerable areas of what is virtually land of no producing-value are usually valued at too high a price under the assumption that this land later on will have a productive worth. Where such areas are very badly infested with weeds, particularly blackberry, the farmer views them as being a great danger to the rest of his holding, and half-hearted attempts to lessen their spread by burning, cutting, and other methods that are only of transient value are carried out. Such methods of control are wrong in principle and often represent a complete waste of money. The first principle with regard to weeds which, when established, require complete eradication in order to make the land reasonably productive is that the farmer should adopt methods of protection of his clean land, rather than make any direct attack on the areas where the weeds have full possession.

In the past far too much emphasis has been given to the menace that large areas of any particular weed may exercise in the invasion

of clean land, and too little emphasis to the practices that must be adopted in order to keep clean land clean. A better knowledge and better application of the principles involved—all of which are connected with pasture maintenance and improvement — would do much towards the solution of the weed problem in connection with our grasslands.

(To be continued.)

RULES FOR CERTIFICATE-OF-RECORD TESTING OF PUREBRED DAIRY COWS.

CURRENT ADDITIONS AND AMENDMENTS.

W. M. SINGLETON, Director of Dairy Division.

WHEN, in June, 1924, the Dairy Division issued, with considerable amendment and addition, a reprint of the C.O.R. rules, it was believed that the matter had at last reached a stage where the need for any serious alteration was likely to be fairly remote. In so brief a space as two years, however, several important irregularities and weaknesses have disclosed themselves, with the result that it has been considered necessary to commence the forthcoming season with a still more comprehensive set of rules. The new edition is now ready for issue.

For the information of *Journal* readers who are interested, the principal additions and amendments are here recorded with brief explanatory comment. The changes are dealt with in numerical order—that is, according to the number of the original rule in which they happen to occur.

In Rule No. 1, under the heading "Change of Ownership during Testing Period," and as a separate clause (*c*), the following provision has been made :—

> The acceptance of an application for the entry of a cow will not bind the Department to continue the supervision of the test in the event of change of ownership during the testing-period. The Department will, however, make every endeavour to continue the test, provided it is notified, within one week after the date of the sale, of the name and address of the purchaser, and provided also that such continuance shall be contingent upon the agreement of the new owner to comply with the rules herein contained.

The object and meaning of the various portions of this clause should be obvious. Firstly, when a cow is accepted for test the Dairy Division has no knowledge of the locality into which she may go in the event of sale, and thus can undertake to continue the test only so long as she remains at the farm on which she was originally entered. Secondly, the Division must be notified promptly of change of ownership, in order to allow time to arrange a visit to the new farm, and also to enable a proper check to be kept on milk-weights as recorded by the purchaser. Thirdly, when a person enters a cow for C.O.R. test he agrees to conform to the C.O.R. rules, but this does not concern the purchaser. In order, therefore, to safeguard the Department and the C.O.R. system it is necessary that the purchaser should signify his agreement to carry out the duties as prescribed for the owner.

In Rule No. 2 an identification safeguard has been provided. The clause which has been inserted reads :—

The owner shall, on request, supply for identification purposes a photograph of any cow entered for C.O.R. test.

Several new clauses, as follows, have been added to Rule No. 3 :—

(*d*.) . . . . In cases where it is found that the owner's milk scales are not reading correctly (either through the scales being inaccurate or through incorrect tare for the weighing-bucket being allowed), the Director of the Dairy Division shall have power to adjust the milk-weights by such amount and for such period as he deems proper.

(*h*.) No cow shall be milked more than three times daily.

(*j*.) The cow shall be milked the same number of times on the days of the Testing Officer's visit as she has been immediately prior to such visit.

(*k*.) The owner or his agent shall see that the milk submitted to the Testing Officer for sampling or weighing, or both, is the milk as it came from the cow, and that nothing has been added or taken away.

(*l*.) The owner shall see that the conditions pertaining to the treatment, milking, &c., of cows on C.O.R. test at the time of the Testing Officer's visit shall meet with the approval of the Testing Officer.

(*m*.) Where the Director of the Dairy Division may consider it necessary the owner shall provide the Testing Officer with free board and lodging during the period of his testing visit.

The meaning of and the need for these additions will be fairly apparent, but a few comments may be added. In regard to clause (*j*) it is evident that the Testing Officer's check on milk-yield would be practically worthless were the breeder permitted to increase or decrease the number of milkings per day for the days the Testing Officer was present for the purpose of carrying out his checking and sampling. With reference to clause (*m*) it may be stated that in the case of some breeders whose farms are in outlying districts there is often no boarding-house or hotel within convenient distance of the testing breeder's farm. In some of these cases the travelling-expenses of the Testing Officer are extremely high, so that, where it may be deemed necessary, it is expected that the breeder who desires his cows tested under the C.O.R. system will assist the Division to carry out the work on his behalf by providing the Testing Officer with free board and lodging during the time it is necessary for him to be at the farm.

To Rule No. 8, "Qualifications relating to Dates of Calving—Premature Calving," the following proviso has been added :—

Provided also that, wherever he may consider it necessary, the Director of the Dairy Division may require the owner to supply a veterinarian's certificate regarding calving subsequent to test.

This, as it will be surmised, is to provide for a greater security in cases where there is insufficient evidence as to the calving or date of calving subsequent to test of any cow which has otherwise qualified for her certificate.

Under Rule No. 9, which treats with the rights and duties of the Testing Officer, the following provision has been added :—

The Testing Officer shall keep the cow and the milker under strict supervision during the whole of the milking operation.

This simply means, of course, that any breeder failing to give the Testing Officer every facility to carry out this branch of his duties will be considered to have made a breach of the C.O.R. rules.

To Rule No. 11 the following clause has been added :—

If the owner of a cow under test or any agent of the owner commits any breach of these rules so as to warrant the discontinuance of the test, the Director may, if he considers the breach of sufficient gravity, discontinue the testing of all or any other cows belonging to the same owner and under test. No refund of fees shall be made in any such case.

There have been some instances of debate among breeders as to who is entitled to the certificate in the case of sale of a C.O.R. test cow. To cover this point a clause, which reads as follows, has been added to Rule No. 14 :—

Every certificate shall appertain to the cow to which it relates, and shall be given to the owner of the cow at the date of her calving subsequent to test. If the owner at that date is not the person who entered the cow for testing, the latter may obtain a copy of her certificate on application in that behalf.

It is considered that this should meet the case quite reasonably and fairly.

Rule No. 17, "Non-issue or Cancellation of Certificate — Issue of Certificate," has been altered and added to so that it now reads as follows :—

(a.) No certificate, either first or second class, shall be granted if in the opinion of the Director of the Dairy Division the milk-weights as forwarded by the owner have not been authenticated, or if the owner commits any breach of these rules : Provided that in cases where the Director of the Dairy Division considers the main objective of the C.O.R. testing will be better met he may issue a certificate based on the recorded milk-weights adjusted to such extent as he deems right and proper.

(b.) A certificate may be cancelled and the record expunged if it subsequently be found that in the opinion of the Director of the Dairy Division, and of the majority of the executive of the breeders' association of which the owner is, or was, a member, the record was not made in accordance with the rules. In any case of the non-issue of a certificate the decision of the Director shall be final, and need not be accompanied by any statement of the reason governing the decision.

(c.) In every case where a cow qualifies for a certificate of record such certificate may be issued and particulars entered in the records of the Department, and forwarded to the secretary of the breeders' association concerned.

In the "Reminders," at the close of the rules, a section referring to declarations has been inserted as follows :—

The attention of owners is drawn to Rule No. 7. The prompt return of declarations not only ensures the issue of certificates, but facilitates the compilation of records, summaries, &c., at the Dairy Division's headquarters.

There is always a small proportion of C.O.R. breeders who neglect to attend promptly to the completing and returning of declarations pertaining to the records of their cows which have completed test. This causes a good deal of inconvenience in connection with the preparation of summaries and returns in the Dairy Division's head office ; further, as no certificate can be issued until such time as the declaration is properly completed and received back, much delay is caused at the end of the calendar year when the annual summary of C.O.R. results is being compiled. Almost annually the summaries are not wholly complete because of a few outstanding declarations. During the last two or three years the matter has become so serious that the Division may have to consider enforcing that portion of Rule No. 7 which provides that if the declaration is not returned within thirty days of date of despatch acceptance of further applications may be refused.

EXPERIMENTS ON MANURING OF POTATOES IN CANTERBURY, SEASON 1924-25.

(Concluded.)

F. E. WARD, Instructor in Agriculture, and A. W. HUDSON, B.Sc., B.Ag., Assistant Instructor in Agriculture, Christchurch.

EXPERIMENT 2: ON FARM OF W. AND A. CAMPION, PREBBLETON.

IN this experiment sowing was done on 17th November, 1924; weighings were made on 27th and 28th July, 1925.

The recent previous history of the field was three years of grass, followed by a winter fallow prior to sowing of potatoes.

As with Experiment 1 (see last month's *Journal*), all plots were sown in quadruplicate, but only one control was included in each series. The insoluble phosphate in this case was Ephos basic phosphate, containing about 62 per cent. tricalcic phosphate. The nitrogen was applied in the form of dried blood.

The series were comprised of the following manurial treatments, applied in the order shown, the manures being sown with the seed throughout :—

	Quantity per Acre.
(1.) Superphosphate, 42/44 grade	3 cwt.
(2.) Super, 1½ cwt.; plus Ephos, 1½ cwt.	3 cwt.
(3.) No. 2 mixture; plus sulphate of potash, ¾ cwt. ..	3¾ cwt.
(4.) No. 2 mixture; plus dried blood, 1 cwt. ..	4 cwt.
(5.) No. 3 mixture; plus dried blood, 1 cwt. ..	4¾ cwt.
(6.) Control.	

Only three rows—all of which were dug and weighed—were allocated to each plot. The average width between the rows was 25 in.

DETERMINATION OF YIELDS.

Digging was done by hand, and sorting carried out with a machine. Areas of ½ chain by three rows, each $\frac{1}{211}$ acre, were weighed in the same way as in Experiment 1, and comparisons made between plots adjacent to one another, except in the case of super plus Ephos *versus* super plus Ephos plus blood. In this case the compared plots were separated by an intervening one.

OBSERVATIONS DURING GROWTH.

One month after sowing the crop was well through the ground, and at this stage the controls were slightly inferior.

On 20th January, nine weeks after sowing, the controls were deciderly poorer in growth than the manured plots, and super, super plus Ephos plus blood, and the complete mixture were a little better than the super plus Ephos and super plus Ephos plus potash mixtures.

As shown in Table 3, the yields of table potatoes were extremely poor throughout. This is attributed to the fact that the ground on which the experiment was conducted had become set rather hard with rain.

It had been intended to plough the seed potatoes in, but owing to the manure-box being unsuitable the planter had to be resorted to, and, instead of a ploughing at planting, the ground was merely ridged. The adjoining part of the paddock, where the seed was ploughed in, gave a much better result. An excellent illustration of the necessity for adequate cultivation of the land was thus provided.

Table 3.—Comparison of Yields in Experiment 2.

Comparison, A *versus* B.	Number of Paired Plots.	Grade.	Yield in Tons per Acre. A.	Yield in Tons per Acre. B.	Difference in Favour of A.	Difference in Favour of B.	Odds.
A. Super	22	**Total**	9·31	6·69	2·62	..	> 24,000
B. Control	22	Table	1·89	1·26	0·63	..	> 24,000
		Seed	4·09	2·80	1·29	..	> 24,000
		Small	3·33	2·69	0·64*	..	..
A. Super plus Ephos ..	30	**Total**	8·22	9·25	..	1·03	> 24,000
		Table	1·40	1·92	..	0·52	> 24,000
B. Super	30	Seed	3·45	3·97	..	0·52	> 24,000
		Small	3·37	3·36	0·01*	..	..
A. Super plus Ephos ..	32	**Total**	8·14	8·45	..	0·34	2,173
		Table	1·39	1·78	..	0·34	> 24,000
B. Super plus Ephos plus sulphate of potash	32	Seed	3·42	3·56	..	0·14	11
		Small	3·33	3·11	0·22*	..	..
A. Super plus Ephos ..	32	**Total**	8·14	8·63	..	0·49	1,000
		Table	1·39	1·59	..	0·20	30
B. Super plus Ephos plus dried blood	32	Seed	3·42	3·66	..	0·24	90
		Small	3·33	3·38	..	0·05*	..
A. Super plus Ephos plus blood	32	**Total**	8·63	8·78	..	0·15	4
		Table	1·59	1·95	..	0·36	> 24,000
B. Super plus Ephos plus blood plus sulphate of potash	32	Seed	3·66	3·79	..	0·13	7
		Small	3·38	3·04	0·34*	..	..

* Not treated statistically.

COMMENTS ON TABLE 3.

Super *versus* control: In this comparison the increase in marketable potatoes (table and seed), valued as in Experiment 1, is worth £3 16s. 6d. The cost of 3 cwt. of super is £1 1s. 9d., so that even in such a poor crop the manure effects a profit of £2 14s. 9d. per acre. There is a decrease of 3·5 per cent. in the percentage of small potatoes due to super.

Super plus Ephos *versus* super: The superiority of super over the mixture of super and Ephos needs no further comment, especially as the costs of each are almost identical. The super shows a 4-per-cent. greater proportion of table potatoes than the mixed phosphates.

Super plus Ephos *versus* super plus Ephos plus potash: The increase in yield of table potatoes brought about by the addition of potash is sufficient to leave a profit of about 6s. per acre—certainly not enough in this case to justify its inclusion, but causing no monetary loss. The potash has caused an increase of 3·5 per cent. in the tables, with a corresponding decrease in small potatoes.

Super plus Ephos *versus* super plus Ephos plus dried blood: The value of the increase of table and seed potatoes due to the blood is about 19s. 6d., against which must be reckoned the cost of 1 cwt. of blood, 13s. Again there is only a slight profit, of 6s. 6d. The blood has caused no significant difference in the percentage of the various grades.

Super plus Ephos plus blood *versus* super plus Ephos plus blood plus potash: The addition of potash to the otherwise complete mixture again shows an increase of about $\frac{1}{3}$ ton of table potatoes (although the total yield is not significantly affected), and a consequent profit of about 6s. per acre. The increase in the percentage of tables is of approximately the same order as when the potash was added to the phosphate mixture. It is problematical whether the potash and blood would have shown a more handsome profit had the crop been an average one, but it seems likely that such would have been the case.

The writers are indebted to Messrs. L. C. Banks and W. Campion for their whole-hearted interest and assistance in carrying out the work, which, with certain modifications, is being repeated on the same farms in the current season.

DRY-PICKLING OF SEED WHEAT WITH COPPER CARBONATE.

FOLLOWING on work carried out at the Ashburton Experimental Farm by Mr. J. C. Neill, Field Mycologist, the Department of Agriculture recently imported two machines (from Australia and America respectively) for the pickling of seed wheat with copper-carbonate dust. These machines were sent to various districts in Canterbury and North Otago, and a proportion of the farmers' seed-supply has been treated.

This season Lincoln Agricultural College sold a large quantity of seed wheat, and arrangements were made with the College for the treating of one-quarter of the supply with copper carbonate. When a farmer ordered wheat from the College, one-quarter of his order was filled with treated seed, and this would be sown alongside the remaining three-quarters, which had been wet-pickled by him.

The advantages of dry-pickling briefly are,—

(1.) Ease and economy of mixing with the seed. Copper-carbonate dust is mixed dry with the seed at the rate of 2 oz. to the bushel (60 lb.) of seed.

(2.) Saving of time. The material can be mixed with the seed during spare time, whenever convenient, and stored until the time of planting.

(3.) Uniform seeding. Seed treated with copper carbonate will not attract moisture or become sticky, therefore will run cleanly through the drills or seeders.

(4.) Less injury to seed, and less retarding of growth. This may result in larger yields due to the increased germination.

The cost of pickling, with copper carbonate at 1s. 3d. per pound, is approximately 2d. per bushel, but this cost would be more than compensated by increased germination of the seed.

—*F. E. Ward, Instructor in Agriculture, Christchurch.*

BUTTER-BOX TESTS.

DEVELOPMENT OF BALANCED CONSTRUCTION TO MINIMIZE BREAKAGE DURING TRANSIT.

W. C. WARD, Forest Products Branch, New Zealand State Forest Service.

INTRODUCTION.

THIS article presents the results of a series of tests made by the Forest Service, at the request of the Dairy Division of the Department of Agriculture, with the object of improving the serviceability of the butter-boxes now used in the export trade. It should be read in sequence to the article, " Butter-boxes and their Design," published in this *Journal* for September, 1924.

The laboratory studies here described combine practical experience—which is a knowledge of the designs in use, of what timber is available, and of box-factory practice—with accurate scientific tests made on the package itself, packed as in actual service and subjected to strains that approximate actual transportation conditions.

The main purpose of the study was to develop a balanced and economical construction—that is, a box which has enough strength in each part for the purpose for which it is intended, and no more strength in any part than is necessary to balance the average strength in every other part. The essential qualifications for an export butter package are (1) that it be strong enough to stand up under exceptional rough handling ; (2) that it be able to resist punctures from the corners or edges of other containers ; (3) that it occupy the minimum of space ; and (4) that it be difficult to open and reclose without special tools—a preventive of concealed pilfering. It was necessary to secure these four qualifications without a burdensome cost.

Although the immediate purpose was to formulate a specification for a standard box for the export trade, the scope of the work was extended to include a study of the various types of containers now in common use, and to provide data for the general instruction of box manufacturers and users regarding certain fundamentals of box design. The study may be still further extended at a later date to investigate other types of butter-containers which appear to promise improvement upon existing practices.

BOXES TESTED.

In developing the new specification the Forest Service considered that the approximate shape of the existing box, which is well known on the butter-markets of the world, should be preserved. In accordance with this principle the inside length of all boxes tested was kept constant at $15\frac{1}{8}$ in., and the cross-sectional dimensions varied to make side and top and bottom boards of equal width, while still keeping the cubical capacity constant.

With the exception of the Saranac box all boxes tested were of the type known as style 1 in the box trade. In this type of box the grain of the ends and sides runs approximately parallel to the top and

bottom surfaces, while the ends are uncleated. Five boxes were tested to study each variable. The results in most cases were consistent enough to give a reliable average based on the tests of only three boxes, and the results for the strapped boxes are based on this number of tests.

The recommendations of the Madison Forest Products Laboratory of the United States Forest Service were followed in the nailing and strapping of boxes. Only 5D and 7D cement-coated nails* were procurable from local stock, and therefore used where 6D would have proved more suitable.

and No. 13½ gauge Gerrard wire, were used on boxes bound with nailless bindings.

Acme flat - steel strapping, ½ in. × 0·018 in. and ⅜ in. × 0·015 in.,

The Saranac box is similar to that shown in Figs. 1 and 2. Fig. 1 shows a "mat" for what is known as a "four-one" box, delivered by a stitching or fabricating machine, ready to be assembled with the end panels, or shipped in this form to the consumer. The cleats are held to the sheet material forming the sides, top, and bottom by staples which pass over the wires, through the sheet material, and have their points firmly held in the cleats. Staples not driven into cleats are clinched in the inside surface of the sheet material. The box is assembled by folding the mat around the two end pieces, which are stapled or nailed on the inside surface of six of the cleats, the remaining cleat on each end being attached to the top only, as shown in Fig. 2. To close the box the binding-wires are twisted together near one edge of a side. The end joints of the cleats may be mortise-and-tenon, step, or plain mitre type.

There are a number of similar boxes on the market, the chief variation being in the method of attaching the ends. The Saranac, for example, attaches only two cleats at each end of the mat, the remaining cleats being stapled to the ends. In assembling the box the sides are stapled to the two cleats attached to the ends. This has the advantage of requiring only an outside stapling-machine, compared with an inside stapler required for the four-one type.

Wire-bound boxes are opened for grading and inspectional purposes by cutting the wires at their original fastenings. They are closed by twisting on a new piece of wire to one of the loose ends and twisting the two wires together again.

TESTS TO DETERMINE BOX DESIGN.

The most practical method yet devised for testing packing-boxes is the revolving-drum test. For this purpose a replica of the machine shown in Fig. 3 was installed by the Forest Service at its timber-testing station maintained at the School of Engineering, Canterbury University College, Christchurch. The drum is a hexagon - sided machine, and revolves slowly at a rate of $1\frac{5}{6}$ revolutions per minute.

* The size of cement-coated nails is expressed in pennies and designated throughout this article by the letter "D." The dimensions are as follows: 4 penny (4D), 1⅜ in. long, 14 A.W. gauge; 5 penny (5D), 1⅝ in. long, 13½ A.W. gauge; 6 penny (6D), 1⅞ in. long, 13 A.W. gauge; 7 penny (7D), 2⅛ in. long, 12½ A.W. gauge. Cement-coated nails are designated by the letters "c.c."

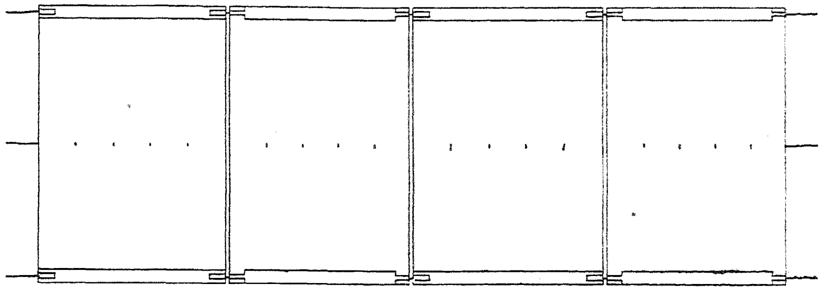


FIG. 1. MAT OF THE FOUR-ONE WIRE-BOUND VENEER BOX.

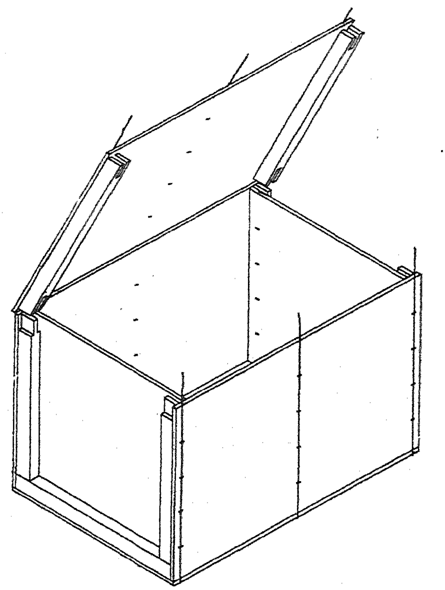


FIG. 2. THE FOUR-ONE BOX ASSEMBLED.

The box to be tested is packed with 56 lb. butter, as in commercial service, and placed in this drum. In the drum is arranged a series of hazards, which cause the box to follow a regular cycle of drops, falling upon sides, top, bottom, ends, edges, corners, and flatwise upon a projection similar to the corner of another box. These drops simulate the usual hazards of transportation. Each face of the drum is counted as one drop.

To facilitate the recording of the locations and character of the failures the faces and edges of the box are numbered as shown in Fig. 4. As the box moves on from one drop to the next the observer notes the beginning of the failure of the weakest point in the construction, and

follows its development and that of other weaknesses until the box entirely fails and lets its contents out. The weak feature of the box may be too few or too short nails, or too thin sides or ends. Such weaknesses are studied until the observer is able to build up a box having equal strength in every feature and capable of delivering its contents in the same condition as when first shipped.

The mechanical tests of the bindings and fastenings were made at the Forest Service timber-testing station maintained at the School of Engineering, Auckland University College.

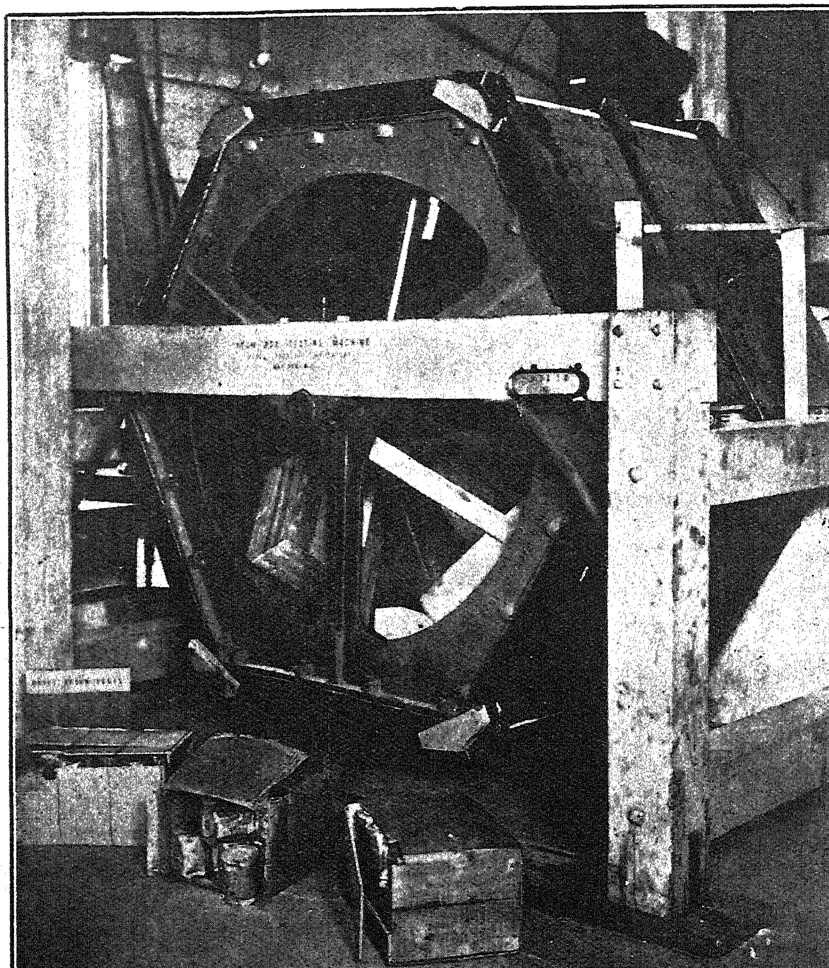


FIG. 3. REVOLVING-DRUM BOX-TESTING MACHINE.

A similar machine—installed at the Forest Service Testing Station, School of Engineering, Canterbury University College—was used for the tests here recorded.

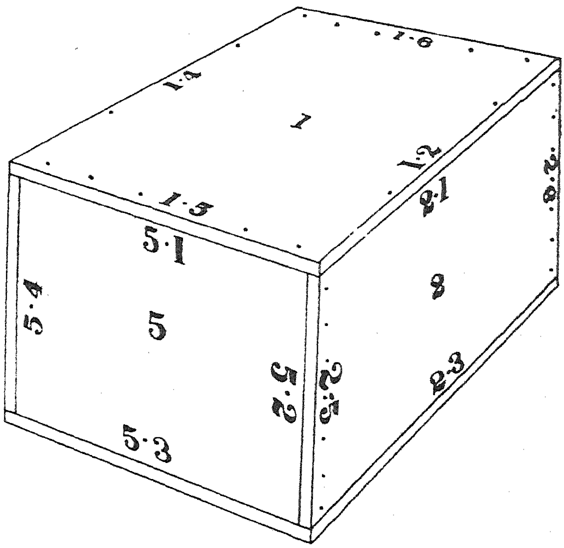


FIG. 4. STANDARD MARKING FOR BOX-TESTS.

Showing method used to assist in recording results of tests and studying weaknesses of construction.

ANALYSIS OF RESULTS.

The results of the tests are shown graphically on a series of charts. A detailed description of the boxes tested immediately follows each chart, which is generally confined to the study of a single variable in design. The length of lines on the chart represents the relative number of drops to cause loss of contents.

For convenience of comparison in making this analysis the white-pine box to the following specification is taken as 100 per cent. for comparing the other designs :—

Inside dimension—$15\frac{1}{8}$ in. long by $11\frac{1}{4}$ in. deep by $10\frac{1}{4}$ in. broad.
Sides, top, and bottom—one piece, $\frac{1}{2}$ in. thick.
Ends—one piece, $\frac{5}{8}$ in. thick.
Nails—Into ends, 5/7D c.c. per nailing-edge.
Space into sides, 2/7D c.c. per nailing-edge.

Chart 1 represents the results obtained from two groups of boxes nailed with ordinary and with cement-coated nails. The failure of the boxes fastened with ordinary nails was in all cases due to pulling of the nails from the end of the box, a weakness which was entirely eliminated by the substitution of cement-coated nails. The chart shows that the serviceability of the box is so improved by the use of cement-coated nails that their general use is recommended to shippers for both export and domestic packages.

Kind of Nails.	Number of Drops required to spill Contents.		Relative Strength to Box with c.c. Nails.
	Graphical Representation.	Number.	
Smooth wire		25	0·13
Cement-coated		190	1·00

CHART I. EFFECT OF SUBSTITUTING CEMENT-COATED NAILS FOR SMOOTH-WIRE NAILS.

Details of Boxes tested.—Timber: N.Z. white-pine. Inside dimensions: 15⅛ in. long by 11¼ in. deep by 10¼ in. broad. Sides, top, and bottom: One piece, ½ in. thick. Ends: One piece, ⅝ in. thick. Nails: Into ends, 5/7D per nailing-edge; space into sides, 2/7D per nailing-edge.

Cement-coated nails are used almost universally by box-manufacturers in Canada and the United States, as they have a much higher resistance to withdrawal than plain uncoated nails. The cement coating of the nail consists of various resinous gums mixed by a secret formula, and put on the nails by a baking process. Though the makers do not claim that the nails are absolutely rust-proof, they do claim that nails thus treated will resist the effects of moisture from 20 to 50 per cent. better than the uncoated wire nail. But it is when in use that the non-rusting quality is most evident. There is more coating on the nails than is actually necessary for holding-power. The heat caused by the friction in driving the nail softens the coating, and the surplus is forced towards the head, completely closing any opening: this prevents the admission of moisture between the wood and the nail. Under similar conditions of use the life of a cement-coated nail will be about twice as long as that of an uncoated one. They are claimed to require less force to drive, as the softened coating forms a lubricant. Any slight difficulties attached to their handling in the box-factory do not outweigh the advantages gained, and it is very desirable that the cement-coated nail should be adopted for boxing-work throughout New Zealand. Whereas a 2 in. cement-coated nail driven 1⅝ in. into the side grain of a piece of American pine required a force of 226 lb. to withdraw it, a common nail under the same conditions was withdrawn with a force of only 106 lb.

Chart 2 shows the relative resistance to loss of contents between the three kinds of boxes in common use in New Zealand. The results are borne out by practical experience. The white-pine box resisted loss of contents more than four times better, and the beech box more than eight times better, than the spruce box. The poor nail-holding quality of the spruce wood and its tendency to split easily are features which do not produce a box of first-class carrying-qualities. Typical splitting of side and end boards is illustrated in Fig. 7.

Species of Timber.	Number of Drops required to spill Contents. Graphical Representation.	Number.	Relative Strength to White-pine Box.
White-pine		190	1·0
Silver-beech		364	1·92
Spruce		44	0·23

CHART 2. EFFECT OF VARYING SPECIES OF TIMBER USED.

Details of Boxes tested.—Inside dimensions: 15⅝ in. long by 11¼ in. deep by 10¼ in. broad. Sides, top, and bottom: One piece, ½ in. thick. Ends: One piece, ⅝ in. thick. Nails: Into ends, 5/7D c.c. per nailing-edge; space into sides, 2/7D c.c. per nailing-edge.

Tests were made with four groups of boxes nailed with five, six, seven, and eight cement-coated nails per nailing-edge. Chart 3 represents the results obtained from these tests. The enormous increase in strength obtained by a small increase in the number of nails is clearly apparent. Most failures commenced by splitting of the sides, followed by splitting of the ends, thus allowing the boxes to break in two, as shown in Fig. 5, which is a photograph of an eight-nailed box.

Number of Nails per Edge.	Number of Drops required to spill Contents. Graphical Representation.	Number.	Relative Strength to Five-nail Box.
5		190	1·0
6		248	1·3
7		580	1·1
8		1,165	6·1

CHART 3. EFFECT OF VARYING THE NUMBER OF NAILS ATTACHING SIDES, TOP, AND BOTTOM TO ENDS.

Details of Boxes tested.—Timber: N.Z. white-pine. Inside dimensions: 15⅝ in. long by 11¼ in. deep by 10¼ in. broad. Sides, top, and bottom: One piece, ½ in. thick. Ends: One piece, ⅝ in. thick. Nails: Into ends, 7D c.c.; space into sides, 2/7D c.c.

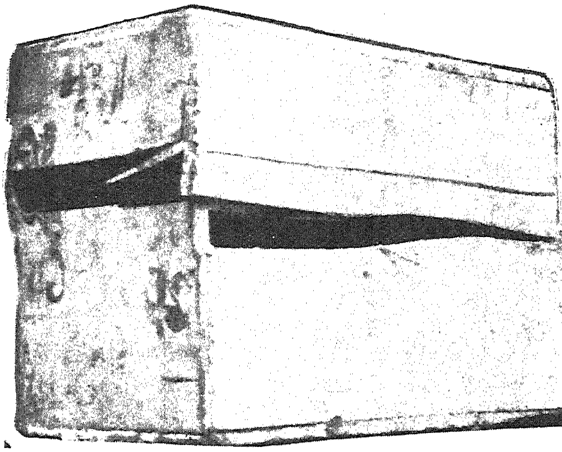


FIG. 5. TYPICAL FAILURE OF UNSTRAPPED BOX (EIGHT NAILS PER NAILING-EDGE).

Split commenced in sides and extended to ends, allowing box to break in two.

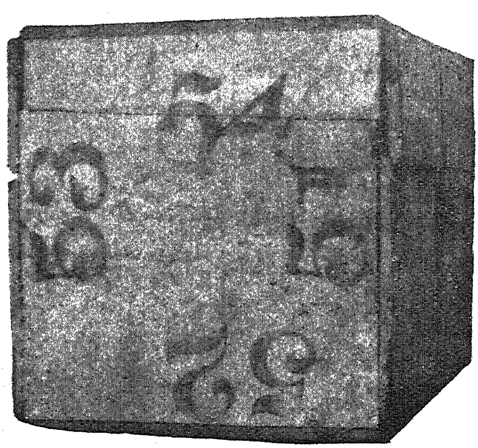


FIG 6. TYPICAL FAILURE OF STRAPPED BOX.

Nature of failure similar to that of unstrapped box in Fig. 5, splitting commencing in sides and extending to ends. Strap still holds two loose halves of box together.

Chart 4 represents the results obtained from the tests of two groups of boxes having one-piece and two-piece sides. The two pieces constituting a side differed considerably in width, and in assembling boxes the joints of the two-piece sides were staggered, so that there was a considerable distance between their respective planes.

Number of Pieces in Sides.	Number of Drops required to spill Contents.		Relative Strength to One-piece-sided Box.
	Graphical Representation.	Number.	
1-piece		190	1·00
2-piece		73	0·38

CHART 4. EFFECT OF VARYING NUMBER OF PIECES IN SIDES.

Details of Boxes tested.—Timber: N.Z. white-pine. Inside dimensions: 15⅛ in. long by 11¼ in. deep by 10¼ in. broad. Sides: ½ in. thick. Top and bottom: One piece, ½ in. thick. Ends: One piece, ⅝ in. thick. Nails: Into ends, 5/7D c.c. per nailing-edge; space into sides, 2/7D c.c. per nailing-edge.

The advantage of single-piece sides is pronounced. They act to reinforce the ends against splitting. The boxes with two-piece sides invariably commenced to fail by splitting of the ends, the split occurring along the nails holding the narrower pieces of the sides.

Chart 5 represents the influence of flat strapping of unannealed metal applied parallel to the ends, and in two directions (one parallel to the ends and the other perpendicular to the grain of the ends). Tests were made on boxes with two thicknesses of sides, top, and bottom—⅜ in. and $\frac{5}{16}$ in.

As has been stated, the box without strapping invariably failed by the sides and ends splitting and allowing the box to break in two. When one strap was applied around the centre of the box parallel to the ends the failures occurred in the same way as before, but only after a much rougher handling than the unstrapped box received. A typical failure is shown in Fig. 6. The two parts of the box were held together by the strap, but the test was discontinued immediately the block of butter became damaged by shearing of these loose parts or by the sides pulling off.

Two flat straps applied 3 in. from each end of the box did not change the nature of the failure, and only slightly better results were obtained. One flat strap applied round the centre parallel to the ends, and another lengthwise of the box perpendicular to the grain in the ends, gave still better results than the two parallel straps, but ultimate failure occurred by the lengthwise strap breaking after the ends had split.

In all cases the boxes with ⅜ in. sides, top, and bottom resisted breakage 50 per cent. better than those of $\frac{5}{16}$ in. material.

A similar series of tests comparing boxes bound with flat straps and round wires of unannealed metal indicates that a hard wire of approximately the same mechanical properties as the flat strapping tested, and with a fastener of equal efficiency, would give results equal to those represented in Chart 5.

Thickness of Sides.	Number and Size of Nails.	Number, Width, and Point of Application of Strapping.	Number of Drops required to spill Contents. Graphical Representation.	Number.	Relative Strength to unstrapped Box.
½ in.	5/7D	..		190	1·0
⅜ in.	5/7D	1—½ in., central		342	1·8
⅜ in.	5/7D	2—⅜ in., parallel		372	2·0
⅜ in.	5/7D	2—⅜ in., crossed		418	2·2
5/16 in.	7/5D	1—½ in., central		230	1·2
5/16 in.	7/5D	2—⅜ in., parallel		267	1·4

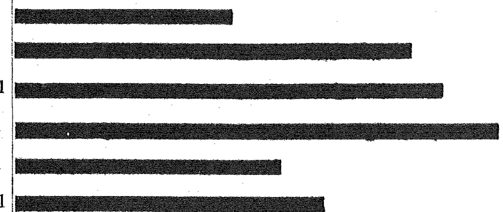


CHART 5. EFFECT OF APPLYING FLAT METAL STRAPPING AND DECREASING THICKNESS OF SIDES.

Details of Boxes tested.—Timber: N.Z. white-pine. Inside dimensions: 15⅛ in. long by 10⅞ in. deep by 10⅝ in. broad. Sides, top, and bottom: One piece. Ends: One piece, ⅝ in. thick. Nails: c.c. Strapping: Maximum tensile strength, 97,500 lb. per sq. in.; efficiency of fastening, 75·2 per cent.; thickness, ½ in. wide by 0·018 in. thick; ⅜ in. wide by 0·015 in. thick.

Thickness of Sides.	Number and Size of Nails.	Number and Point of Application of Wire Binding.	Number of Drops required to spill Contents. Graphical Representation.	Number.	Relative Strength to unstrapped Box.
½ in.	5/7D	..		190	1·0
⅜ in.	5/7D	1—central		154	0·81
⅜ in.	5/7D	2—parallel		216	1·14
5/16 in.	7/5D	1—central		124	0·65
5/16 in.	7/5D	2—parallel		192	1·01

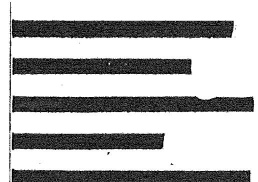


CHART 6. EFFECT OF APPLYING ROUND WIRE BINDING AND DECREASING THICKNESS OF SIDES.

Details of Boxes tested.—Timber: N.Z. white-pine. Inside dimensions: 15⅛ in. long by 10⅞ in. deep by 10⅝ in. broad. Sides, top, and bottom: One piece. Ends: One piece, ⅝ in. thick. Nails: c.c. Wire binding: Maximum tensile strength, 60,000 lb. per sq. in.; efficiency of fastening, 86·2 per cent.; gauge, No. 13½ B.W. gauge.

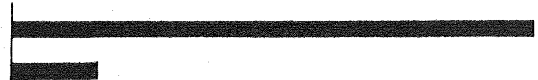
Type of Box.	Number of Drops required to spill Contents. Graphical Representation.	Number.	Relative Strength to Unstrapped Box.
Unstrapped		190	1·00
Saranac		31	0·16

CHART 7. TEST OF SARANAC WIRE-BOUND BOX WITH PRESENT STANDARD UNSTRAPPED BOX.

Details of Boxes tested.—Timber: N.Z. white-pine. Inside dimensions: 15¼ in. long by 11 in. deep by 10¼ in. wide. Sides, top, and bottom: Two piece, ¼ in. thick. Ends: One piece, ¼ in. thick. Cleats: 13/16 in. wide, ¾ in. thick. Staples: Spaced 2 in. apart. Binding: 14½ B.W. gauge.

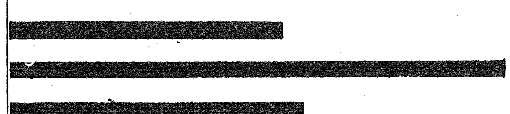
Species of Timber.	Thickness of Sides.	Number of Straps and Point of Application.	Number of Drops required to spill Contents. Graphical Representation.	Number.	Relative Strength to unstrapped White-pine Box.
White-pine	½ in.	..		190	1·00
White-pine	⅜ in.	1—central		342	1·80
Spruce	½ in.	1—central		203	1·07

CHART 8. COMPARISON BETWEEN NEW ZEALAND WHITE-PINE AND IMPORTED SPRUCE BOXES.

Details of Boxes tested.—Inside dimensions: ½ in. sides—15⅛ in. long by 11¼ in. deep by 10¼ in. broad; ⅜ in. sides—15⅛ in. long by 10⅞ in. deep by 10⅝ in. broad. Sides, top, and bottom: One piece. Ends: One piece, ⅝ in. thick. Nails: Into ends, 5/7D c.c. per nailing-edge; space into sides (½ in.), 2/7D c.c. per nailing-edge. Strapping: Flat, hard metal, ½ in. wide by 0·018 in. thick.

The influence of wire binding of annealed metal applied similarly to the flat strapping is represented by Chart 6. Tests were made on boxes with two thicknesses of sides, top, and bottom, $\frac{3}{8}$ in. and $\frac{5}{16}$ in. While some increased serviceability might be obtained by increasing the size of the wire to 13 B.W.G., as recommended by the wire-binding manufacturers, the tendency of the annealed metal to stretch quite early in the test reduces its efficiency as a binding. Fig. 7 illustrates the stretching of these bindings. The results are similar to those secured in other series of tests. The increased serviceability of the box with $\frac{3}{8}$ in. sides, top, and bottom over that with $\frac{5}{16}$ in. material was not as great as with flat strapping of unannealed metal.

Chart 7 shows the comparison between the present standard unstrapped box (with $\frac{1}{2}$ in. sides, top, and bottom, and $\frac{5}{8}$ in. end, but nailed with 5/7D c.c. nails per edge) and the Saranac wire-bound box.

The tests show that the Saranac boxes submitted for test were unsuitable for export shipment. They had less than one-sixth the resistance to loss of contents of the $\frac{1}{2}$ in. unstrapped boxes, failure occurring by puncturing of the thin sides. The wood appeared to be brittle, probably arising out of the drying of the wood at too high a temperature. Even with this fault remedied, however, the $\frac{1}{4}$ in. sides would be too thin.

Chart 8 shows that the imported spruce box reinforced with one $\frac{1}{2}$ in. central flat strap is little superior to the unstrapped white-pine box, and markedly inferior to the $\frac{3}{8}$ in. side white-pine box reinforced with one $\frac{1}{2}$ in. central flat strap.

CONCLUSIONS.

The results of the foregoing studies may be summarized as follows :—

(1.) The use of cement-coated nails is essential if an economical and balanced package is to be designed.

(2.) Adequate nailing is of the utmost importance in box-construction.

(3.) Silver-beech ranks first, white-pine second, and spruce last in suitability for butter-boxes when carrying-qualities are considered.

(4.) The one-piece-side box is markedly superior to the two-piece-side box.

(5.) Flat strapping or wire binding of unannealed metal is of great value as a reinforcement on all boxes.

(6.) Resistance to loss of contents increases with the number of straps used. Two straps applied in two directions gave better results than two straps applied parallel.

(7.) Decreasing the thickness of sides, top, and bottom of white-pine boxes below $\frac{3}{8}$ in. results in marked reduction in strength.

(8.) Wire bindings of annealed metal increase the resistance of a box to loss of contents, but are inferior to flat strap or wire binding of unannealed metal.

(9.) Sides less than $\frac{5}{16}$ in. in thickness puncture easily. The drying of thin boards by artificial heat should be carefully controlled to prevent brittleness.

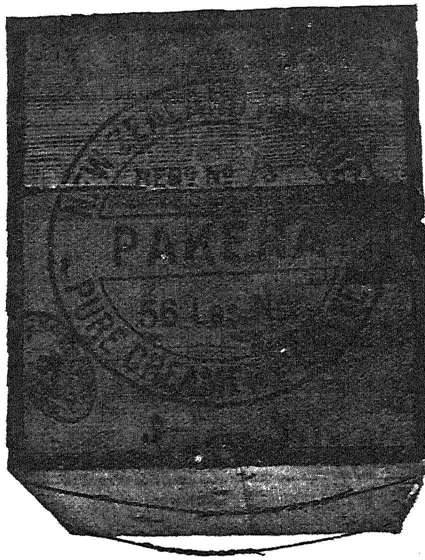


FIG. 7. SHOWING STRETCHING OF WIRE BINDINGS OF ANNEALED METAL.

Such bindings stretch easily and lose their efficiency as a box-reinforcement.

FIG. 8. THE PROPOSED STANDARD STRAPPED BOX.

Fourteen times stronger than the present unstrapped box; occupies 3 per cent. less space; is from ½d. to 1½d. cheaper—depending on the sawmiller's prices.

RECOMMENDATION FOR STANDARD BOX.

Having consideration to the various factors involved the Forest Service recommends the use of *one standard box for the export trade.* This package is similar to that shown in Fig. 8.

It consists essentially of one-piece ends, $\frac{5}{8}$ in. thick if white-pine, or $\frac{1}{2}$ in. thick if silver-beech; one-piece sides, top, and bottom, $\frac{3}{8}$ in. thick if white-pine, $\frac{5}{16}$ in. thick if silver-beech; six cement-coated nails per nailing-edge, 6D ($1\frac{5}{8}$ in.) for white-pine, 4D ($1\frac{3}{8}$ in.) for beech; and one centrally located galvanized strap of hard (unannealed) metal, $\frac{1}{2}$ in. wide by 0·018 in. thick. Spruce is not a suitable wood for this construction.

The box is approximately fourteen times stronger than the present standard unstrapped package, occupies 3 per cent. less space, is from 1d. to $1\frac{1}{2}$d. cheaper, and withal is a highly attractive package, which will maintain on the world's markets that individuality of get-up which until last season has always characterized New Zealand dairy-produce abroad.

A detailed specification for the package follows:—

SPECIFICATION FOR STANDARD METAL-BOUND BUTTER-BOX FOR EXPORT.

Section A: General.

(1.) Definition: The box as herein specified shall be known as the standard metal-bound butter-box—export type.

Section B: Timber.

(2.) Woods used: The following timbers shall be admitted under this specification: White-pine (*Podocarpus dacrydioides*) and silver-beech (*Nothofagus Menziesii*).

(3.) Material: (*a.*) The ends, sides, top, and bottom of the box shall be well manufactured, and shall be cut true to size. All defects in the timber which materially lessen the strength of the part, or expose contents to damage, or interfere with proper nailing, shall be prohibited. (*b.*) The wood shall be thoroughly seasoned, and shall have a moisture content not less than 10 per cent. nor more than 18 per cent., based on the weight of the wood after oven-drying to a constant weight.

(4.) Dimensions: (*a.*) The inside dimensions of the box shall be $15\frac{1}{8}$ in. long by $10\frac{3}{8}$ in. deep by $10\frac{3}{8}$ in. broad. The width of ends, sides, top, and bottom shall be $10\frac{3}{8}$ in. (The top and bottom do not cover completely the edges of the sides, which will be sprung inwards when the strapping is applied. This will assist to keep the strapping in tension.) (*b.*) The sides, top, and bottom shall be $\frac{3}{8}$ in. thick for white-pine boards, and $\frac{5}{16}$ in. thick for beech boards; the ends shall be $\frac{5}{8}$ in. thick for white-pine boards, and $\frac{1}{2}$ in. thick for beech boards. (*c.*) The variation in thickness of the boards below the thickness specified shall be not more than $\frac{1}{32}$ in., and this variation below the specified thickness shall not extend over more than 10 per cent. of the face of that particular board.

(5.) Width of parts: (*a.*) Ends, sides, top, and bottom shall be of single-piece material. (*b.*) Matched and glued or lock-jointed boards shall be regarded as single pieces.

(6.) Jointing: (*a.*) Matched and glued ends shall, in addition, be fastened with not less then two galvanized corrugated fasteners, 1 in. by $\frac{3}{8}$ in. (*b.*) All corners shall be chamfered.

(7.) Surfacing: (*a.*) The outside surfaces of the sides, top, and bottom may be fine band-saw or veneered finish; otherwise they shall be smooth-planed. (*b.*) The ends shall be veneered or smooth-planed.

(8.) Assembling: Joints in matched and glued sides shall be so located that there is a considerable distance between their respective planes.

Section C: Nailing.

(9.) Nailing schedule: (*a.*) $1\frac{5}{8}$ in. cement-coated nails (*i.e.*, nails coated with a resinous solution) shall be used when driving into white-pine ends, and $1\frac{3}{8}$ in.

cement-coated nails when driving into beech ends. (*b.*) Nails shall be driven flush. (*c.*) The sides, top, and bottom shall be attached to the ends by not less than six nails per edge.

Section D: Metal Binding.

(10.) Metal: (*a.*) Metal binding shall be of hard unannealed metal, and shall have a maximum tensile strength of approximately 84,000 lb. per square inch. (*b.*) The binding for export boxes shall be galvanized or otherwise treated to protect against rust.

(11.) Fastenings: The ends of bindings shall be fastened in such a manner that the joint shall have a breaking-strength of not less than 75 per cent. of the ultimate strength of the binding.

(12.) Size of binding: The metal binding shall be not less than ½ in. in width by 0·018 in. in thickness, or wire of equivalent sectional area.

(13.) Application: (*a.*) Not less than one binding shall be used, placed centrally round the smallest dimension of the box at right angles to the side edges of the box. (*b.*) The binding shall be drawn sufficiently tight to sink well into the edges of the box and to spring the sides inwards.

SUMMARY.

The foregoing series of strength tests of various types of butter-boxes was made by the Forest Service to determine the accuracy of its recommended specifications discussed in the September, 1924, issue of this *Journal.*

The Forest Service has developed as a result of these tests an attractive metal-strapped box fourteen times stronger than the present unstrapped box, occupying 3 per cent. less room, and costing from ½d. to 1½d. less. A detailed specification for its manufacture is submitted.

The tests further indicate the superiority of cement-coated nails over smooth wire nails, and of the white-pine and beech boxes over the imported spruce packages, whether from North America or Scandinavia.

ACKNOWLEDGMENTS.

The following organizations have co-operated with the Forest Service in the work here described: Dairy Division, Department of Agriculture—general; School of Engineering, Canterbury University College—box tests; School of Engineering, Auckland University College—binding tests; Messrs. J. F. Hargreaves and Co. (Limited), Wellington, New Zealand agents for Acme strapping; Papanui Cool Stores (Limited), Christchurch—general; Johnson, Clapham, and Norris (Limited), Wellington, and United States Steel Products Company, New York—cement-coated nails.

Special acknowledgment is due to the Madison Forest Products Laboratory of the United States Forest Service for its many reports upon box design. These have enabled the present work to be carried to a conclusion without the laborious investigation of many features of design already studied by the American laboratory.

The planning, supervision, and presentation of the study have been under the charge of Mr. A. R. Entrican, Engineer in Forest Products, State Forest Service.

NOTE.—In addition to the article "Butter-boxes and their Design," the following matter dealing with the same subject generally has been published in this *Journal*: "Metal-bound Butter-boxes" (October, 1924); "Effect of Projecting Staples on Butter packed in Four-one Boxes" (July, 1925).

THE OFFICIAL SEED-TESTING STATION.

RECORD OF OPERATIONS FOR 1925.

N. R. Foy, Seed Analyst, Biological Laboratory, Wellington.

For the twelve months ended December, 1925, 8,146 seed-samples were tested at the Seed-testing Station. Of these samples, 1,242 were also analysed for purity. The total shows a decrease of 120 on the number tested for the previous year. Samples from farmers, included in the aggregate tested, numbered 203.

The movement of the testing-work throughout the year is shown in Table 1, and the number of samples of the various species tested is given in Table 2, both being compared with the preceding year. Including 1923 in the survey, there is in most cases a marked regularity over the last three years, the exceptions being an increase in dogstail and brown-top, and a decrease in white clover, cow-grass, cocksfoot, lucerne, and vegetable seeds.

Table 1.—Number of Samples received in the Different Months, 1925 and 1924.

Month.	Number. 1925.	Number. 1924.	Month.	Number. 1925.	Number. 1924.
January	553	556	July	537	469
February	700	748	August	852	699
March	878	866	September	895	1,014
April	659	853	October	740	556
May	592	938	November	683	506
June	674	650	December	403	411

Table 2.—Number of Samples received of the various Species, 1925 and 1924.

Species.	1925.	1924.	Species.	1925.	1924.
Lucerne	62	103	Paspalum	77	56
Alsike	75	74	Poa pratensis	60	51
White clover	237	293	Prairie-grass	25	19
Cow-grass and red clover	276	439	Other grasses	61	72
Crimson clover	35	25	Japanese millet	28	32
English trefoil	38	27	Oats	48	42
Lotus major	55	50	Other cereals	42	35
Other clovers	60	49	Mangolds	249	208
Perennial rye-grass	1,178	1,031	Turnips	449	417
Italian rye-grass	260	255	Swedes	290	133
Western Wolths rye-grass	194	176	Rape	184	86
Timothy	97	69	Kale	46	39
Crested dogstail	874	641	Chou moellier	38	34
Danthonia spp.	99	47	Carrots	89	82
Brown-top	124	54	Mustard	32	29
Chewings fescue	431	490	Forest-tree seeds	23	20
Meadow-fescue	37	33	Flower-seeds	14	24
Meadow-foxtail	49	49	Vegetables(other than peas)	250	410
Yorkshire fog	25	11	Peas (garden)	197	260
Cocksfoot	387	516	Tares, vetches, &c.	12	16

GRASSES.

Germination.—The average percentages of purity and germination of the main grass-seed are shown in Table 3. On the whole the average germination has been well maintained, with the exception of dogstail and Chewings fescue, where there is a decline, due in the case of dogstail to an increased percentage (23) of samples germinating in the seventies, and in Chewings fescue to the receipt of a large number of samples of interior seed in November and December (see Table 4).

To obtain an indication of the average growth of good-grade seed reference should be made to the figures in the various groups in Table 4. For example, timothy shows an average growth of 84 per cent., but this is low for good seed. The grouping shows that 69 per cent. of the seed grows over 90 per cent., and that the average of 84 has been pulled down by 15 per cent. of old samples growing under 50 per cent. First-grade timothy should therefore germinate over 90 per cent. Cocksfoot, on the other hand, shows a much wider range of growth; anywhere between 61 and 90 per cent. may be expected, depending upon the origin of the seed, whether Danish or Akaroa. Table 5 shows a difference of nearly 10 per cent. in the average growth of the two seeds, and that, while 40 per cent. of Danish germinates between 81 and 100 per cent., only 7 per cent. of Akaroa germinates in the same group. Therefore Danish should be expected to grow over or near 80 per cent. and Akaroa under 80 per cent.

The average growth of other grasses, &c., not included in the tables is as follows: Fiorin, 76 per cent.; Poa trivialis, 54 per cent.; ratstail, 30 per cent.; sheep's fescue, 40 per cent.; yarrow, 75 per cent.

Table 3.—Average Germination and Purity of the Main Grasses, 1925.

Species.	Percentage of Germination.			Percentage of Samples germinating between						Average Percentage of Impurities.	
	Average.	Highest.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.	Useful.	Weeds.
Perennial rye-grass	85	100	2	3	4	6	9	31	47	0·7	0·5
Italian rye-grass	87	100	32	2	2	5	9	29	53	0·5	0·2
Western Wolths rye-grass	88	100	7	2	1	3	9	32	53	0·2	0·2
Timothy ..	84	100	2	15	..	..	5	11	69	1·5	0·2
Crested dogstail	79	98	..	6	3	8	23	39	21	1·1	0·2
Cocksfoot ..	69	93	7	11	15	22	27	23	2	3·6	0·6
Brown-top* ..	67	98	20	16	14	29	15	19	7	0·7	1·1
Chewings fescue	73	100	0	22	5	9	15	25	24	1·1	0·5
Meadow-fescue ..	73	98	1	18	8	8	14	14	38	0·1	0·8
Poa pratensis ..	51	93	1	33	28	26	8	3	2	0·2	0·8
				0–20.	21–30.	31–40.	41–50.	51–60.	61–100.		
Meadow-foxtail..	21	43	2	36	43	8	6	7	..	5·7	3·1
Danthonia spp...	38	75	..	22	14	18	16	18	12	10·1	5·9
Paspalum ..	43	94	3	10	9	23	29	17	2	0·1	0·1

* Average content of chaff and inert matter in brown-top, 31 per cent.

Table 4.—Monthly Average Germination of the Main Agricultural Seeds.

Species.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average for Year. 1925.	1924.
White clover	90	89	92	88	93	91	88	90	91	88	89	87	89	88
Alsike	88	76	89	90	..	..	96	87	90	84	96	86	88	86
Cow-grass	92	89	90	90	80	84	91	86	91	84	90	88	88	91
Crimson clover	96	98	95	98	98	..	..	99	98	85	99	98	95	93
Lucerne	91	65	90	..	92	92	85	88	88	90	86	91	88	90
English trefoil	70	50	65	..	..	48	96	92	75	88	77	86	79	74
Lotus major	79	66	46	64	77	83	88	88	53	83	..	82	75	76
Perennial rye-grass	83	84	85	84	80	88	84	90	86	86	88	87	85	86
Italian rye-grass	86	85	87	89	94	89	85	88	89	91	80	91	87	87
Western Wolths rye-grass	89	84	88	91	84	83	92	87	85	95	86	89	88	90
Timothy	93	84	95	80	..	96	93	86	63	88	91	94	84	90
Brown-top	58	70	59	66	75	74	79	78	73	71	72	48	69	61
Red-top	..	82	..	..	..	..	80	95	..	93	..	77	83	75
Chewings fescue	78	82	63	91	86	73	73	68	65	83	46	45	73	80
Meadow-fescue	90	94	70	40	..	..	..	95	67	72	85	66	73	58
Meadow-foxtail	28	..	14	22	27	33	17	22	23	14	14	11	21	30
Danthonia	9	34	38	40	..	47	69	..	35	35	36	32	38	35
Poa pratensis	64	62	64	50	46	52	78	54	40	41	37	12	51	52
Prairie-grass	55	..	57	72	..	91	..	37	76	89	92	..	69	77
Crested dogstail	83	81	78	81	79	82	74	83	82	79	76	78	79	87
Cocksfoot	69	72	65	72	67	76	70	69	67	68	70	69	69	62
Paspalum	69	48	46	44	39	37	48	51	42	37	37	31	43	36
Oats	51	55	70	95	97	99	98	97	95	99	..	99	84	92
Peas	96	97	96	93	95	82	81	85	99	..	..	..	93	92
Turnip	85	87	89	89	90	91	90	82	92	88	84	91	87	90
Swede	76	74	73	85	86	86	86	84	87	85	86	83	84	86
Rape	90	98	94	75	91	88	88	85	90	92	88	91	89	89
Kale	67	90	..	98	88	91	60	80	94	84	82	78	86	80
Mangold*	119	134	126	135	128	83	81	72	70	77	68	79	74	..
Mustard	83	79	..	..	96	95	52	92	85	94	94	90	87	87
Carrot	61	49	71	62	72	57	74	72	57	65	..	67	69	66
Rye-grass—														
Southern	88	74	90	90	87	90	85	90	85	85	90	91	88	84
Canterbury	87	86	85	89	83	86	88	92	91	89	91	85	87	91
Sandon	81	64	67	62	60	66	27	56	68	82	55	84	67	82
Hawke's Bay	92	90	93	93	..	90	91	93	93	89	91	89	91	90
Poverty Bay	..	86	..	92	..	..	76	..	..	88	91	..	82	94
Cocksfoot—														
Danish	71	83	73	79	..	81	72	73	71	74	74	68	73	66
Akaroa	49	71	62	67	65	..	66	57	66	66	..	67	64	63
Plains	68	..	..	..	76	74	..	..	..	..	..	72	73	68
Dogstail—														
Southern	84	..	75	85	80	82	73	85	84	79	77	77	79	88
Sandon	86	..	68	86	88	75	91	80	75	81	..	77	80	90

* The three-figure averages shown up to May on mangold-samples were computed from tests in hich the total number of sprouts per one hundred clusters were counted. From June the method was nged, and the number of clusters showing sprouts were taken as the germination percentage.

Table 5.—Average Percentage Purity and Germination of Perennial Rye-grass, Crested Dogstail, and Cocksfoot according to Origin, 1925 and 1924.

Origin.	Average Percentage of Impurities.	Percentage of Samples germinating				Average Germination.		Number of Samples.	
		81–90.		91–100.					
		1925.	1924.	1925.	1924.	1925.	1924.	1925.	1924.
				Perennial Rye-grass.					
Southern ..	0·6	36	33	52	35	88	84	421	377
Canterbury ..	1·1	34	15	47	66	87	91	258	226
Sandon ..	0·5	21	36	10	28	67	82	122	157
Hawke's Bay	0·5	23	8	69	84	91	94	120	61
Poverty Bay..	..	30	5	50	80	81	94	13	23
				Crested Dogstail.					
Southern ..	0·5	40	34	20	50	80	88	713	486
Sandon ..	2·0	22	24	40	65	80	90	67	75
				Cocksfoot.					
		61–80.		81–100.					
Plains ..	3·5	36	60	45	12	73	68	11	24
Akaroa ..	4·0	59	50	7	10	64	63	70	100
Danish ..	0·9	42	41	40	25	73	66	127	152

Purity.—Table 6 shows the average purity (the percentages being broken up into useful and weed impurities), together with the percentage of samples in which the various impurities occurred. In two cases only—cocksfoot and Yorkshire fog (used mainly for export)—does the percentage of seed-impurity exceed 2 per cent., and in both these the bulk of the impurity is useful seed. Of the noxious impurities Californian thistle occurred to the greatest extent. It was noted in 60 per cent. of the Southern samples and 53 per cent. of the whole of the samples, at the average rate of 240 seeds per pound—the highest rate being 3,800 and the lowest two seeds per pound. Californian thistle was noted also in a very few samples of Chewings fescue, Italian rye-grass, and alsike. Ox-eye daisy was less frequent in occurrence, and was noted mainly in brown-top, cocksfoot, timothy, and Yorkshire fog. One sample of brown-top contained 5,000 seeds per pound, the average being 1,800. Dodder was noted in a single sample of brown-top, at the rate of 1,000 seeds per pound. This is an unusual impurity in grass-seed.

Brown-top samples contained on the average 31 per cent. of chaff and inert matter, the highest quantity being 65 per cent. Only a small number of fully dressed samples were received for testing.

Table 6.—Occurrence of the Main Impurities of the Grasses, 1925.

The figures placed after each impurity are the percentages of samples in which the impurity occurred in the species of seed at head of the columns—*e.g.* goose-grass occurred in 75 per cent. of the samples of perennial rye-grass examined.

Impurities.	Perennial Rye-grass.	Italian Rye-grass.	Western Wolths Rye-grass.	Timothy.	Crested Dog's-tail.	Cocksfoot.	Brown-top.	Chewings Fescue.	Yorkshire Fog.	Poa pratensis.
Total percentages ..	**1·2**	**0·7**	**0·4**	**1·7**	**1·3**	**4·0**	**1·8**	**1·7**	**9·1**	**1 0**
Useful Seeds.										
Average percentages	**0·7**	**0·5**	**0·2**	**1·5**	**1·1**	**3·6**	**0·7**	**1·1**	**7·5**	**0·2**
Perennial rye-grass ..	..	..	..	5	86	93	..	93	84	5
Yorkshire fog ..	40	7	..	9	95	71	18	77	..	7
Cocksfoot	29	..	7	..	40	..	4	44	38	6
Italian rye-grass ..	74	..	..	..	..	1	..	..	..	..
Crested dogstail ..	15	..	..	10	..	10	17	40	95	..
White clover ..	28	10	..	82	20	10	25	7	100	53
Suckling-clover ..	36	55	48	5	40	5	32	10	100	12
Alsike	19	..	4	68	5	10	...	3	58	12
Cow-grass	5	8	7	50	2	15	..	4	9	18
Poa pratensis ..	1	7	..	45	28	64	4	3	76	..
Agrostis spp. ..	2	..	..	22	8	11	..	2	5	59
Lotus spp. ..	..	3	..	..	..	..	77	..	..	..
Timothy	1	..	..	..	3	15	4	1	63	89
Weed-seeds.										
Average percentages	**0·5**	**0·2**	**0·2**	**0·2**	**0·2**	**0·6**	**1·1**	**0·5**	**1·6**	**0·8**
Hair-grass ..	68	58	57	8	36	12	23	60	10	..
Goose-grass ..	75	77	71	..	..	51	..	11	..	..
Catsear	35	13	14	..	68	25	52	90	9	6
Sweet vernal ..	10	10	4	5	29	7	27	47	90	..
Rib-grass	9	7	28	46	13	37	23	4	84	29
Sorrel	31	29	28	27	24	21	25	30	84	30
Curled dock ..	4	3	..	41	2	15	..	1	..	45
Californian thistle ..	2	3	..	6	53	..	..	1	10	..
Hawkweed ..	3	..	..	9	56	15	13	1	76	..
Ergot sclerotia ..	22	13	11	64	35	15	76	9	79	65
Ox-eye daisy ..	..	..	..	9	1	5	13	..	9	..
Fat-hen	2	..	4	14	..	4	..	..	14	12
Chickweed ..	1	..	..	15	10	4	25	2	71	24
Toad-rush ..	1	..	..	5	2	..	58	3	14	6
Hawk-bit	15	4	7	..	19	5	10	3	..	..

Table 7.—Average Germination and Purity of the Main Clovers, &c., 1925.

Species.	Percentage of Germination.			Percentage of Samples germinating between						Average Percentage of Impurities.			Percentage of Hard Seeds.
	Average.	Highest.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.	Total.	Useful.	Weeds.	
White clover ..	89	100	36	11	1	2	4	22	60	3·3	2·6	0·7	11·3
Alsike ..	88	100	27	6	2	2	8	17	65	1·6	1·3	0·3	4·5
Cow-grass ..	88	99	10	4	2	3	7	18	66	2·6	0·3	2·3	4·8
Lucerne ..	88	100	62	..	2	3	13	35	47	1·6	0·5	1·1	8·1
English trefoil ..	79	98	32	9	5	8	16	25	37	0·3	0·1	0·2	4·6
Crimson clover ..	95	100	9	3	..	..	..	..	97	0·1	..	..	..
Lotus major ..	75	98	22	14	7	7	27	27	18	15·5	14·9	0·6	27·2
Subterranean clover	77	98	36	10	6	17	17	22	28	0·1	..	..	26·0

CLOVERS AND RELATED SPECIES.

Germination.—The average purity and germination of the main clovers, &c., are shown in Table 7. The average germination remains at much the same level as in preceding years. The percentage of hard seed still remains high, particularly in Lotus major, subterranean clover, and white clover, and is the cause of the depression of all the average germination percentages, except in crimson clover.

The average germination of clovers, &c., not included in the table is as follows:—

	Germination. Per Cent.	Hard Seeds. Per Cent.
Suckling-clover	77·0	27·0
Egyptian clover	95·0	..
Strawberry-clover	75·0	25·0
Lotus hispidus (angustissimus) ..	57·0	28·2
Lotus corniculatus	54·3	42·0

Purity.—Table 7 shows the average percentage of impurity, divided into total, useful seeds, and weed-seeds. As is usual, Lotus major and white clover show the highest impurity, the greater part in both being made up of useful seed. On the other hand, cow-grass, usually looked upon as one of the purest of seeds, has a higher weed content than any of the other grasses and clovers. Reference to Table 8 shows this to consist of rib-grass, sorrel, and curled dock. Smaller percentages of suckling-clover in white clover were noticed, the highest being 9 per cent. Lotus hispidus was present in 45 per cent. of the Lotus major samples, compared with 90 per cent. in the previous year. The amount varied from 1 per cent. to 40 per cent., the average being 15·5 per cent. Some of the samples contained up to 12 per cent. of white clover.

As regards noxious impurities, only 8 per cent. of the white clover samples and 2 per cent. of the cow-grass samples examined contained dodder. This occurred in varying amounts, from fourteen to 1,500 seeds per pound. Twenty-one per cent. of the Lotus major samples contained dodder, from forty to 11,000 seeds per pound. Many of these were Auckland-grown samples. Californian thistle was noted in 11 per cent. of the alsike, in very small quantities.

The following extract from one of the tables of the annual report of the Official Seed-testing Station for England and Wales for 1924–25 is of interest in that it shows New Zealand red clover (cow-grass) and white clover in comparison with that from other countries from a purity and germination point of view:—

	Average per Cent. of Impurities.	Average Germination per Cent.	Average per Cent. Hard Seeds.
Red Clover.			
English	4·29	73·9	4·1
French	4·45	77·0	3·0
Czecho-Slovak	6·70	84·5	6·5
Chilean	2·01	86·5	4·4
American	2·30	90·2	4·0
New Zealand	1·32	90·5	4·3
White Clover.			
English	6·32	83·7	6·7
Mid-European	3·77	85·3	7·8
New Zealand	2·82	80·1	15·7

It will be observed that in both species of New Zealand clovers the percentage of impurities is the lowest, and that the percentage of living seed (taking into account the hard seed) is also the highest.

Table 8.—Occurrence of the Main Impurities of the Clovers, &c., 1925.

The figures placed after each impurity are the percentages of samples in which the impurity occurred in the species at head of the columns.

Impurities.	White Clover.	Alsike.	Cow-grass.	Lucerne.	Lotus major.	English Trefoil.
Useful Seeds.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
White clover	..	100	65	7	70	12
Cow-grass	62	72	..	81	18	31
Alsike	87	..	35	..	20	20
English trefoil ..	21	95	18	6	..	..
Rye-grass	15	6	21	13	3	..
Lucerne	1	..	26	..	3	10
Timothy	38	94	5	..	45	..
Lotus spp.	4	..	..	..	45	..
Yorkshire fog	24	10	..	..	46	..
Crested dogstail ..	9	11	5	..	21	10
Suckling-clover ..	89	10	11	13	67	24
Poa pratensis ..	6	10	5	..	12	9
Cocksfoot	4	..	5	..	2	..
Haresfoot trefoil ..	16	..	3	..	6	..
Agrostis spp.	6	..	..	..	40	..
Weed-seeds.						
Sorrel	92	39	57	..	67	..
Rib-grass	66	28	90	19	49	40
Scarlet pimpernel ..	50	..	..	..	..	..
Chickweed	31	..	..	..	15	12
Catch-fly	31	..	..	..	12	..
Dodder	8	..	2	..	21	..
Spurrey	17	..	..	..	12	..
Mouse-eared chickweed..	23	17	..	..	42	10
Selfheal	24	10	15	..	36	..
Fat-hen	52	6	9	13	6	10
Night-flowering catchfly	7	50	6	..	..	22
False flax	2	61	..	..	..	..
Californian thistle ..	..	11	..	..	..	..
Curled dock	1	10	54	19	..	32
Wireweed	7	..	21	18	..	9
Field-madder	5	6	20	6	3	80
Field-melilot	..	..	7	6	..	10

ROOTS AND CRUCIFEROUS FORAGES.

The average germinations of this class are given in the following table :—

Table 9.—Average Germination Percentages of the Main Roots and Cruciferous Forages, 1925.

Species.	Percentage of Germination.			Percentage of Samples germinating between					
	Average.	Highest.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.
Turnip ..	87	100	12	1	1	5	9	23	61
Swede ..	84	100	7	6	5	6	11	23	49
Rape	89	100	47	1	3	2	8	28	58
Kale	86	99	26	2	7	9	1	24	57
Mangold ..	74	95	22	6	8	20	32	30	4
Chou moellier ..	87	100	51	..	4	..	18	39	39
Carrot ..	69	92	25	11	11	34	30	10	4

CEREALS AND MISCELLANEOUS FORAGES.

The average germination percentages of these seeds were as follows: Wheat, 98; oats, 92; barley, 75; rye-corn, 95; Japanese millet, 94; Sudan grass, 88; sorghum, 71.

PEAS, TARES, AND LUPINS.

The average germinations in this class were as follows: Peas, 92; tares, 97; blue lupins, 83.

VEGETABLES.

The number of samples and the average germination percentages of the main vegetable seeds tested are shown in the following list:—

Seed.	Number of Samples.	Average Germination.	Seed.	Number of Samples.	Average Germination.
Beet	4	63	Melon ..	26	86
Broccoli ..	2	56	Onion ..	49	66
Cabbage ..	26	73	Parsnip ..	13	67
Celery ..	4	78	Parsley ..	3	41
Cauliflower ..	10	74	Pumpkin ..	6	84
Cucumber ..	14	86	Radish ..	5	91
Leek	6	65	Rhubarb ..	5	74
Lettuce ..	8	98	Spinach ..	10	17
Marrow ..	15	74	Tomato ..	10	92

GENERAL.

In addition to the more routine work of the Station some 870 miscellaneous laboratory tests were made during the year, also 117 special agricultural tests.

For purposes of further comparison, those interested are referred to the Seed Station report for 1924, published in the *Journal* for May, 1925.

Acknowledgment is made of the computation of the figures in this record by Mr. W. J. Cooch, of the Seed Station staff.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 11th March to 22nd April, 1926, include the following of agricultural interest:—

No. 53149: Device for feeding cows in bails; I. B. Cruickshank, Otewa. No. 53404: Milking-machine; H. McCormack, Glen Ridge, New Jersey, U.S.A. No. 53674: Manure and seed distributor; W. M. D. Meares, Te Puna. No. 55710: Sheep-shear shear-plate; Chicago Flexible Shaft Co., Chicago, U.S.A. No. 53786: Tractor-wheel attachment; E. D. C. Withell, Mayfield. No. 53956: Milking-machine stripper attachment; J. H. Mason, Feilding. No. 54025: Cheese-press hoop; W. Harvey, Auckland. No. 54108: Separator; R. A. Lister and Co. and P. H. Watts, Dursley, England. No. 55800: Device for forming butter into blocks; J. A. Miller, Auckland. No. 54193: Milking-machine pulsator-valve; D. M. Wallace, Ltd., Hamilton. No. 55539: Milk sampling and weighing apparatus; J. J. Raynes, Rukuhia. No. 55767: Incubator egg-tray; M. C. Byrne, Bankstown, N.S.W. No. 54163: Tractor-seat back-rest; E. C. D. Withell, Mayfield. No. 55000: Sprayer-nozzle; J. C. Kay, Auckland. No. 55104: Animal-trap; W. and G. Sidebotham, Wednesfield, England.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price 1s.

SEASONAL NOTES.

THE FARM.

WINTER FEEDING OF STOCK.

On most dairy farms supplying factories the herd will now be dried off and feeding-out of supplementary forages should be general. Dairy cows should be building up for next season's lactation period. It is therefore necessary that they be given the best of treatment now, even if they have to go a little short in the spring. Cows that are well cared for during the winter will stand a pinch in the spring, when the days are getting longer and warmer. On the other hand, if they are neglected in winter and allowed to get low in condition no amount of spring feeding will make up for it. A cow down in condition is unable to get the best out of the food she eats; but if she is in good fettle she will make the most of the food value, and in consequence do better on a much smaller ration than that consumed by an animal in poor condition.

On farms where root crops are grown for dairy cows the roots should, as far as possible, be pulled and fed out to the animals. The average cow running on, say, a field of swedes will eat and spoil from 80 lb. to 120 lb. of roots per day. She would be healthier and do better on half this amount fed out on a clean paddock, together with some clean hay, at the rate of 15 lb. or 20 lb. per day. The hay should be carted out and spread thinly on dry areas to prevent loss by trampling. For sheep, when fed extra in this way, about 1 lb. of hay per day, together with 15 lb. to 20 lb. of roots, suffices. Hay is best fed to sheep out of racks.

Oat-straw, although of lower food value than hay, makes excellent feed for store stock. It is usually carted out to the paddocks and spread around. Wheat-straw is unpalatable and poor in food value, and as a rule should not be used.

Autumn-sown cereals and temporary pastures should be reaching usefulness during the coming month. Chou moellier and other kales are now providing forage, and should be fed with a reasonable ration of hay or other dry fodder.

In many districts dairy-farmers will now be using ensilage, and where cows are not used to this fodder a start should be made with a small quantity — say, 4 lb. to 6 lb. per head per day. This may be increased to 30 lb. or 40 lb. per day at the end of a week. The latter amount is the maximum quantity that it is desirable to feed at this season of the year. When starting to feed ensilage care should be taken to see that all is cleared up from day to day. When opening a stack or pit only a given surface area should be uncovered, the aim being to remove at least 6 in. from the top each day. Ensilage deteriorates rapidly, and should not be exposed longer than necessary; consequently it is better fed straight from the stack to the stock.

More use could with advantage be made of concentrates, especially for dairy cows. In general, the most suitable are crushed oats, crushed

linseed-cake, or peas. When used, a mixture is often fed in shallow troughs, together with chaff, at the rate of 4 lb. to 6 lb. of the mixture per head of cattle per day, or 1 lb. for sheep.

The most economical method of feeding off a crop of turnips or swedes with sheep is by folding. A block is fenced off and stocked with hoggets and old ewes, which eat off the tops. They are then put on to a new block, while the sheep intended for fattening are allowed to eat down the bulbs of the first block. The shells that remain are then grubbed out for the flock ewes. Sheep should not be put on to roots for too long a period at first, nor if there is frost on the leaves. If there is not a run-off on to a grass-paddock, racks with hay or straw should be placed in the field.

PASTURES.

Young permanent pastures should be very carefully managed during their first winter. They should not be grazed close, and never with heavy stock while the soil is inclined to be in a wet or sodden condition. Even sheep should be kept off if the ground is very soft.

The feeding of hay and roots on the poorer and drier spots of the older pastures, with the object of developing a better fertility and consolidation, should be continued.

During June and July opportunity should be taken to tripod-harrow old pastures while they are bare. Thorough harrowing of old pasture is important in removing harsh unpalatable growth, while at the same time assisting to invigorate the old crowns by breaking the surface soil and admitting the air so necessary to healthy plant-growth.

Stumping can now be conveniently carried out on the older bush-burns. The removal of logs, &c., will allow renovation methods to be put into practice. The tripod harrow will then be able to do its work, and, in conjunction with top-dressing, greatly improved pastures will result. Bracken and other fern and piripiri are torn out by the reversible tripod harrows, and can be thus more readily kept in check. Late autumn-sown secondary burns should now be top-dressed. This will result in a good spring growth, and allow heavy stocking to take place just when the bracken and other secondary growth is making a strong bid for mastery. Paddocks containing steep dangerous faces and "tomos" should now be spelled where practicable, heavy cattle at least being removed to easier ground.

Pasture top-dressing and liming were dealt with at some length in the *Journal* for March and April.

CULTURAL WORK.

Owing to the very dry autumn experienced in many districts this year cultural work has to a great extent been held in abeyance, but if proper provision is to be made for next season's root crops no time should be lost in getting selected areas turned over. Old pasture should be ploughed in wide furrows and laid flat where brown-top, Chewings fescue, &c., are troublesome. This method induces a better decay of the whole turf, and lessens the chance of these mat-forming species springing again between the furrows. Land recently cropped and now being ploughed for bare fallow should be left as rough as possible so that the greatest possible surface will be exposed to the weather.

Lea land can be ploughed fairly wet, but work should be discontinued if the furrow shows a glaze from the mouldboard. Recently cropped land should never be worked while wet, otherwise the soil-texture, which is very important, may be badly damaged, and this cannot easily be remedied. As far as possible at this season one should plough with the fall of the land, so that drainage may be assisted.

Where mangolds or potatoes are to be sown next spring, farmyard manure or old stack-bottoms should be carted out, well spread, and ploughed in. Early winter ploughing and plenty of organic manure are essential for these crops, especially potatoes.

If, during wet weather, low-lying patches of ground in the cereal crops become covered with water, these may be drained most easily by means of the mould-plough. With this implement a shallow drain can be made from the wet area to any convenient ditch.

LUCERNE.

Old stands of lucerne, if not yet attended to, and providing the soil is dry enough, should now be thoroughly grubbed and cleaned up, and where necessary limed. An average dressing would be 1 ton of crushed limestone per acre, or about 12 cwt. of crushed burnt lime. Keeping the stand clean through the winter is of great importance, having a very beneficial effect on the ensuing spring growth. Young stands sown in the past season should on no account be grazed this winter, and should receive a phosphatic top-dressing before spring. Where stands are weak in places and indicate nitrogen-hunger a dressing of suitable nitrogenous manure just as growth commences will greatly stimulate growth.

WORK IN THE IRRIGATION DISTRICT OF OTAGO.

In Central Otago where irrigation farming is practised the chief work, apart from ploughing, will be that of running contour ditches to those parts of the paddocks which could not be properly irrigated during the past season.

As the subsoils of Central Otago in general do not differ very materially from the surface and subsurface, deep ploughing should be resorted to. The reason why the surface soil does not differ much from the subsoil may be explained by the fact that the fine particles are not moved downward to any extent by percolating water. The subsoil of arid areas, as a rule, does not possess the raw or unproductive nature that characterizes the subsoil in most wetter districts. In Central Otago, therefore, with very few exceptions, deep ploughing may be done without detriment immediately preceding the sowing of the crop; in fact, the practice is of very great benefit, because it allows deeper root-penetration and a greater retention of moisture.

In certain parts of Otago only a light layer of mica-schist soil exists, the subsoil being more or less pure gravel. It would, of course, be folly to plough this type of land deeply or to use it for cropping purposes. The best method of dealing with it is to skim-plough and get it sown down in some such permanent crop as lucerne or grass. The ploughing-in of green crops of clover, mustard, and the like will also be of assistance in giving body and depth to light soils, and every irrigator should endeavour to build up the poorer types of soil in this manner.

—*Fields Division.*

THE ORCHARD.

THE PRUNING SEASON.

PRUNING of stone-fruit trees can now be proceeded with, and it is well to get this work advanced when the opportunity offers. Pruning is one of the phases of fruitgrowing that requires care and judgment, and it should not be entered upon without carefully reviewing the conditions relating to the previous season's performance of each particular tree, and noting the promise for the next season's crop. For instance, one may have to deal with peach-trees of an age when good judgment will decide that the previous crop has been too much for the tree, and the time has come to remove some of the older wood so as to encourage again that normal balance between wood-growth and bearing-capacity so much desired. The removal of small branches is generally preferable to removing large limbs, and the younger trees should be so trained that a permanent foundation be laid from which in later years there should be no difficulty in securing cropping-wood.

Plum-trees.

The Japanese varieties on the whole are sturdy growers, and can be shaped into strong, well-spaced trees, thereafter being kept pruned fairly hard each year, and retaining sufficient spear-like lateral growths around the main and sub leaders for cropping. Being mainly all vigorous growers, there is usually no dearth of good fruiting-wood to choose from, and it must be borne in mind that the Japanese varieties crop on yearling wood as well as on spurs.

After English plum-trees are trained to shape, lighter pruning is desirable, and a good proportion of medium wood-growths and laterals can be allowed to go uncut for a year or two till good crops are produced, when cutting-back can again be resorted to.

Cherry-trees.

According to the variety, trees of this fruit may be stiff and upright or willowy and pendulous. The former type should be framed as obliquely as possible, and the side shoots utilized to produce spurs and laterals for future cropping. The second type should receive careful attention and treatment to ensure stability and uprightness of growth during the first few years. When this is assured the pendulous growths can be encouraged for fruiting, and when these become too numerous some should be cut away from time to time in order to admit the light that is so essential to the ripening of the wood and spurs and to fruit-development.

Peaches and Nectarines.

The heaviest and most regular crops are obtained from trees kept in a comparatively vigorous condition. The young trees should be trained with a sturdy base, with mains tending toward the horizontal, so as to obviate overcrowding of the annual fruiting-wood in future years. Peach and nectarine trees vary a good deal in the way in which they carry the fruit, some varieties spurring more freely on the stouter wood than others, while others will not crop freely unless a proportion of the terminals of the lateral growths are left intact. The moderately strong shoots can be shortened back according to the positions of the fruit-buds. Some varieties carry the fruit-buds nearer the extremity than

others, and careful observation will guide the pruner as to the procedure. It should be borne in mind that the best fruit is borne on the shoots and laterals of the previous season's growth, and that the supply of this class of growth must be encouraged in the positions desired and according to the requirements of the tree. The small fruiting-twigs must not be pruned, but those not required for the current season's crop should be eliminated just above the basal buds, from which should be produced shoots for the next season.

Apricots.

In localities suited to the growing of this fruit heavy annual prunings can be resorted to on all free-cropping varieties. Like the peach, the young trees should be trained with a sturdy base and main limbs well spaced. On the free-fruiting varieties short fruit-bearing shoots spring from all round the limbs, and there is usually no very great difficulty in deciding which to eliminate or retain for fruiting. Some of the stronger yearling shoots can be retained in part where space will allow, which will produce desirable fruiting-wood for the next season and increase the production of the tree from year to year. There are some varieties, notably the Roxburgh Red, that require the retention of lateral growths uncut before good crops can be secured, and once the trees are well balanced very little pruning for a year or so is instrumental in bringing this class of tree into bearing. With the apricot pruning is not always the greatest factor to success. The tree is very susceptible to the influence of soil and climatic conditions, and the successful growing of this fruit outside the Teviot and Central Otago districts (with a few isolated exceptions elsewhere) should not be lightly entered upon. No system of pruning appears to be of definite advantage unless other conditions are suitable for its successful culture.

—*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

Citrus-trees will require light protection in localities which are known to be subject to frosts. Once trees have attained a height of several feet little damage is done except by very severe frosts. There are, however, many localities in which adult trees thrive quite well, but young trees require protection for the first few years. This protection is best afforded by a sack or scrim covering fixed to stakes or a clump of rough scrub-cuttings arranged to arch over the tree. Such shelter should not be made dense, but left rather open, on the north and north-east side in particular, to allow early and midday full sunlight. Trees which are so planted as to be exposed to wind or keen draughts through an insufficient shelter-belt will also winter better if protected by a screen.

During the winter season much damage is done by excessive moisture, and it pays to attend well to the drainage and disposal of surplus surface water.

The season is now right for the plantation of shelter-trees. Citrus-trees of all kinds are very sensitive to cold draughts, and this point is important in selecting a shelter-hedge, though first consideration must be given to plants known to succeed in the district and on the class of soil being dealt with. Equal consideration must be given to selecting a hedge-plant, or combination of plants, which will give shelter right to the ground.

In most citrus-groves drone trees are to be found—trees which have failed to crop satisfactorily, or which for some unknown reason are more prone to verrucosis. These is also the tree (very common in the Auckland district) of excessive vegetative habit. The working of these trees with buds from an approved tree will remedy this condition in shorter time than by planting a substitute young tree. Such trees should be cut back to the main arms now, and they will make quite a number of young shoots by spring, and give the required class of wood in which to insert buds.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

PREPARATIONS FOR THE HATCHING AND BROODING SEASON.

ALTHOUGH it will be several weeks yet before breeding and hatching operations commence, nevertheless there are many details that should be attended to in the interim. In point of fact, everything should be done to ward off avoidable trouble when the busy season arrives. The incubators and brooders should be carefully examined and special care taken to see that they are in thorough working-order. It may be found that fresh burners for incubator-lamps are required, or new connecting-rods for the machines where the old ones have been bent, or set-screws which have become worn and liable to cause a serious accident at any time. Maybe a new thermometer to suit some special make of incubator is required.

Where these and other duplicate parts of incubators or brooders are required it is a mistake to leave the purchasing to the last minute. Now that there are so many different styles and makes of incubators and brooders on the market it is often found difficult, or indeed impossible, to replace any part of them unless from the oversea country in which they are manufactured. It is quite a common thing for me to receive during the breeding-period urgent inquiries asking where some part of a particular make of incubator or brooder may be had, and usually the only reply I can give is that it is not procurable in the Dominion. It is safe to say that many an incubator (and, to a less degree, brooder) has had to remain out of commission during the whole or part of the hatching season merely because some duplicate part was unprocurable when required.

There are many other things that should be attended to at this comparatively slack season of the year—such as the cleaning-up of the plant, the mending of gates, fences, &c., and the sweetening of any stale runs by digging them over and planting some quick-growing succulent green-stuff suitable for the early hatched chicks. Such work done now will enable the necessary time to be devoted later to the critical work of hatching and brooding the new flock.

In successful poultry-keeping there must be a time for everything, and May to June is the period for doing all the odd jobs for which time cannot be spared at later periods of the year. It is always a wise course to prepare well ahead for the hatching and rearing season, then the drudgery so usually associated with poultry-keeping will be largely eliminated.

THE ADULT STOCK.

The favourable weather conditions generally prevailing of late will no doubt largely account for the great bulk of the birds which in many flocks have continued to lay to a much later date than is usually the case. Flocks have recently come under my notice where a surprising number of birds were still holding on to their old feathers and giving exceptional egg-yields for this season of the year. One breeder who has had this experience is anxious to know if I consider it a wise course for him to continue forcing his birds for eggs. He further asks whether this would not have the effect of weakening the stamina of the birds, especially seeing that they will later have to undergo the moulting process, and at a time when extremely cold weather conditions may be expected. In the case of birds intended for next season's breeding-pens I would strongly advise that they be discouraged from laying and encouraged to moult by providing a plain ration, also subjecting them to a change of quarters and frequent changes of diet. A good plan to hasten the moult and retard egg-laying is to supply an all-grain ration for a few days, and then suddenly change it to an all-mash diet. With birds that are to be kept for egg-production only I would recommend that an endeavour should be made to secure every available egg in view of the high current prices ruling.

Referring again to the prospective breeding-birds, the whole object should be to have these in the best possible condition by the time the breeding season arrives, and this cannot be done unless they have had good time to recuperate after an exhausting laying season. Obviously, the bird that has been forced to the limit right into the late autumn, and has later to undergo the heavy strain entailed on the system by moulting and renewing its feathers, will not be in a fit condition during the breeding-period to produce eggs with the strongest germs. On no account should the prospective breeding-bird be allowed to get into an overfat condition just prior to or when called upon to produce eggs for the renewal of stock, otherwise trouble may be surely anticipated. The treatment the birds receive now will largely influence not only the hatching-quality of the eggs, but also the vigour of the chicks produced. The aim should be to maintain the hens in a more or less lean, hard, healthy condition. This does not imply any stinting of diet. The birds should be well fed and nourished, but in order to prevent the accumulation of surplus fat they should be encouraged to take ample healthy exercise. If the breeding-birds are to be maintained in their best vigour, and be capable of producing eggs with a desired strength of germ, they should have a free range (or, at any rate, a good-sized yard), affording some semblance to the condition their nature demands. In a general way the coddled bird is not the ideal specimen to breed from for the maintenance of a heavy-producing flock.

THE AGE FOR CULLING.

A correspondent asks, "At what age do fowls become unprofitable to keep?" This is an inquiry which cannot be answered with any great degree of satisfaction. As with many other things connected with poultry, this question can be decided only after consideration of the quality of the stock and of the local conditions surrounding them. For example, in almost every flock are to be found individual birds that it will pay to discard at, or even before, the termination of their first

laying season—in other words, when they are about eighteen months old. The proportion of birds that should be culled from the flock at this age largely depends on the quality of the parents which the stock is bred from, also the manner in which the latter have been fed and managed. The wise poultry-keeper who ensures that no bird is bred from unless possessing outstanding points indicative of strong constitutional vigour and productive power, and, further, takes special care that the young stock are well fed and managed right through the whole of the developing stage, will have in his flock very few birds which will not more than pay their way for at least two laying seasons. Indeed, in a well-bred and well-managed flock of highly productive fowls many hens will be found that will give a profitable egg-yield (over the cost of their keep) right up to the end of the third laying season.

Thus the question of the correct age at which to cull fowls can be decided only in accordance with the quality of the individual members of a flock. Of course, it will seldom or never pay to keep a bird beyond the third laying season, unless it is of a noted breeding-type and is required for the breeding-pen. The man of experience with a trained eye for form can, with a great degree of certainty, by the observation of particular points in a bird, ascertain at a glance whether it possesses high or low egg-producing capacity, and whether it will pay or not to retain it in the flock, and this quite irrespective of the age of the bird.

In previous issues of the *Journal* much advice has been published relative to culling unprofitable stock, and I would urge my correspondents to carefully study and act on this advice.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

WEEDS AND HIVE-STANDS.

PERHAPS at no other season is it so necessary to keep the hive-entrances absolutely free of obstruction as at present. Vegetation during the next few months is rarely dry, even in fine weather, and the apiarist should see that when the bright sunshine of early winter days tempts the bees to a flight they run no risk of being caught in long grass, weeds, &c., thereby becoming chilled and losing all power of ever re-entering the hives. By removing such growths from around the hives now the entrances will remain clear for the next few months; and if the ground is treated with a dressing of agricultural salt in sufficient quantity before the spring growth starts there should be no trouble of the sort throughout the ensuing season.

In no case should hives be placed directly on the ground, or the bottom-boards will soon rot and have to be replaced. The hives should stand sufficiently high above the ground to avoid dampness, and it is an excellent plan to stand them on four half-bricks placed one at each corner of the bottom-board.

Should the apiary be in a permanent situation, no better plan can be followed than to provide concrete hive-stands. These stands have been used in New Zealand for quite a number of years, and have saved the users a great deal of labour by preventing the growth of weeds and by affording protection against insect-life. They are expensive to lay

down in the first place, but, being permanent, will remain in position indefinitely. If concrete stands are adopted they should extend a few inches in front of the alighting-boards, so as to prevent vegetation from growing too close to the entrances of the hives.

In all cases the hives should have a light cant towards the entrances in order to permit of the water leaving the bottom-boards readily. The presence of moisture will lead to much loss to the beekeeper, besides causing the hives to become sour and foul-smelling.

SHELTER.

With the approach of winter and its frequent rough weather the apiarist should turn his attention to the all-important question of shelter. Even if this provision entails a certain amount of outlay it will in the end prove one of the greatest economies the beekeeper can achieve. Not only does he obviate the danger of having hives blown over and lids removed, with the resultant losses by cold and exposure, but he will find in the spring that the well-sheltered, warmly situated colonies have wintered with not only a minimum of losses, but also with a minimum consumption of stores. The colony which has to winter in a cold, exposed situation will require to consume far more honey to keep itself alive than the colony whose compact cluster is unaffected by cold and damp. In the latter case, also, the bees will have a far greater degree of vitality with which to face the strain of spring breeding. Bees require just as much attention and care at the approach of winter as at the beginning of summer, and the careful beekeeper will see that they are so treated that, so far as his hives are concerned, he can regard southerly gales, snowstorms, and severe frosts with equanimity.

PLANS FOR NEXT SEASON.

During the off season is the best time to make plans for the following season. The beekeeper should decide what increases he desires to make, and should prepare accordingly. Making up hives and frames is exasperating work if left till the bees are crying out for room, and it should be finished long before the actual time for increasing one's stock arrives. The beekeeper should also face the question of providing himself with stocks of foundation, and make arrangements for the treatment of his surplus wax by some neighbouring maker of foundation. He should also decide on which market he wishes to place his crop, and lay his plans accordingly. It is advisable, too, that he consider the theoretical side of his occupation, and study, while the bees are in a dormant condition, the best methods of improving his stocks. Neither weather conditions, locality, nor any other factor will influence the honey crop so much as strong colonies of bees, and the apiarist should endeavour, while he has the time, to ensure that these shall be in existence during the coming summer.

THE BEEKEEPERS' ANNUAL CONFERENCE.

A reminder may be given that the National Beekeepers' Association meets in conference in Hamilton on 8th to 11th June inclusive. Papers dealing with various phases of the industry are to be read. A display of beekeeping appliances and honey competitions will form a feature of the proceedings. —*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

THE month of June takes us fairly into winter, and at this period vegetable crops planted out about the New Year are being harvested, while others planted in late autumn are maturing for a harvest in early spring. Although the most carefully made plans have sometimes to be amended at the last moment, the successful planter has to constantly study the future and weave plans if the most is to be made of the "present" as it passes. In order that the planting season may not find one unprepared, the warmer, better-drained land suitable for the earlier crops must be taken in hand if it is not already receiving attention. Wet, rough weather will constantly interfere with the work; grass sod turned in takes time to rot; working out twitch and yarrow is a long tedious job; and hardy cover crops take time to grow. These are some of the reasons for an early commencement of the preparation of the soil for the first planting made on the warmer land at the beginning of spring.

Planting leads one to the consideration of seed, about which there are three points worth careful consideration. They are the kind, the variety, and the strain of seed to be planted. For a few generations it was the fashion to try and grow every possible kind of fruit and vegetable, and have them available at all seasons. This extravagance led to many wonderful horticultural feats being accomplished, and perhaps man's power to rule the vegetable kingdom was never more ably demonstrated than during that period.

In these days of economy, however, one avoids the more difficult and expensive undertakings, and humours nature by growing chiefly such crops as are suited to the soil and climate, and planting them at periods that are also naturally adapted. The more kinds of vegetables and fruits planted the more work is there in growing and marketing them. For this reason there is a tendency to grow rather larger areas of fewer kinds and those most suitable to the local conditions.

The perusal of a seed-catalogue with its long list of varieties of different kinds of plants is very attractive, especially the list of new varieties so big with promises; but here again fancy has to be ruled by local conditions and market demand. The result of such rigorous ruling gives a very much greater average result, although a delicate choice variety is sometimes ruled out as uncommercial. While the testing in small quantities of new varieties from reliable sources is well worth while, yet for the main crop one is well advised to sow such varieties only as are proved suitable to the district. The different qualities and habits in different varieties of the same kind of plants are extraordinary, and the reasons are frequently unknown.

The third point—seed-strain—is important; one may have a crop of broccoli of a variety commonly grown with success in a locality, but it is uneven in type, with many "rogues" (useless plants), the reason probably being that the seed has not been saved with that care which is necessary in order to obtain the best results. High-grade seed is expensive; the lower price of other grades of the same variety sometimes appeals, but it is disappointing, especially when suitable land and every other attention have been given. Disappointment is often entirely

due to this cause alone. As a commercial grower cannot afford to take this risk, every care is taken to get the best strain in vegetable and tomato seeds.

Small quantities of early-potato seed may be set out in trays to sprout, but the larger quantities are rarely given that treatment. It is important, however, that they be kept from growing long useless shoots and thus thoroughly spoiled. Bags of seed potatoes are best stored in the light under cool, airy conditions.

HOTBEDS FOR INDOOR TOMATOES.

Main-crop tomatoes to be grown under glass are usually started towards the end of June. As the seed is raised on hotbeds a commencement should be made to get the materials together. An even, lasting temperature is only obtained by setting up an even fermentation throughout the whole mass. This is done by placing the fresh stable manure in a compact heap, and, when fermentation has started, by restacking the heap, damping down dry material with water. This has the effect of distributing the fermentation, and after repeating it two or three times the correct condition is established throughout and maximum results are obtained.

Where a good, clean compost has been prepared over an extended period there need be little fear of trouble with the seedlings; but those who are not so fortunate as to have such a favourable start may prefer to sterilize the soil for the seed-boxes. This may be done by baking the soil, or by saturating it with boiling water or a 1-per-cent. solution of formalin. In the latter case two or three weeks should elapse before sowing.

SMALL-FRUITS.

Where the planting of bush fruits and strawberries has to be carried out every opportunity should be taken, when the land is dry, to thoroughly clean it of weeds and turn in suitable manures. Complete the planting of strawberries as early as possible, and the bush fruits any time the land is in condition after the preparation is complete.

TOBACCO-CURING.

The tobacco crop is now in the process of curing, and, although short in quantity owing to dry weather, much of it is in excellent condition so far. The temptation to cure unripe leaf should be resisted, for, like unripe fruit, its attractive qualities have not yet developed, and it can never be satisfactory to the consumer. Some growers are packing their leaf close together on the tier-poles, sometimes even tying stalks together and straddling them across the curing-sticks. This is at first an advantage in that the close, moist atmosphere develops a good colour in the leaf, but, if allowed to continue, the delay in drying out and a falling temperature induce moulds which are detrimental. As soon as a good colour is attained the quicker the leaf is dried the better it will be and the better it will keep. This can best be done by spacing it out sufficiently wide apart. A dusty tobacco is unpleasant to smoke, owing to the small particles drawn into the stem of the pipe. Good leaf is not only bright and even in colour, of heavy body, and good texture, but it should be whole. Torn leaves are seriously depreciated in value and cause dust and waste. —*W. C. Hyde, Horticulturist.*

REVIEW.

MONOGRAPH ON THE NEW ZEALAND BEECH FORESTS: PART I. THE ECOLOGY OF THE FORESTS AND TAXONOMY OF THE BEECHES. By L. COCKAYNE, F.R.S., Ph.D., F.N.Z.Inst., Honorary Botanist to the State Forest Service. Royal octavo; seventy-one pages, with forty-four illustrations and two maps. New Zealand State Forest Service Bulletin No. 4. Wellington: Government Printer, 1926. Price 4s.

THE Director of Forestry, the Forest Service officials, and their distinguished Honorary Botanist are alike to be congratulated on the publication of this valuable monograph. The present part deals with the purely scientific aspect of the problems, is written with the author's usual lucidity and vigour of style, and requires only a reasonable mastery of technical terms (for which a glossary is to be provided in Part II).

The objects of the research, the meaning of ecology, and the need for a Dominion forest policy based on a study of our own forests, and not on that of the very dissimilar European ones, are pointed out in the introduction. "By finding out, indeed, how nature works it becomes possible to utilize that knowledge and to draw up rules by which the natural processes can be hastened or retarded, and the forest made to behave, within limits, as the forester may desire." Cogent reasons are given for the important step taken in subdividing our forests into the classes (*a*) "subtropical rain-forest," (*b*) "subantarctic rain-forest," and for placing our southern-beech forests in the latter class. The reviewer regrets that the author has not retained, and the Service adopted, the term "southern-beech," rather than the still misleading "beech," though the utterly erroneous "birch" has, we hope, finally received its quietus.

The "Classification of the Beeches" is made clear by full and easily worked keys for the identification of the species and their hybrids, illustrated by excellent drawings and by reproductions of the original plates in *Icones Plantarum* (1844). The distinctiveness of *Nothofagus truncata* and *N. fusca* is well shown, and the differences between the often misunderstood *N. Solandri* and *N. cliffortioides* are so stated that further mistakes should be impossible. The fascinating matter of hybrid beeches is correctly dealt with only in sufficient detail for the purposes of forestry, but adequate directions are given for the recognition of such. The utter confusion of the popular names used is strikingly revealed, but the important matter of "how to remedy a state of affairs so utterly absurd" is reserved for Part II.

The distribution of the species is taken up in the third section, where is indicated both what is known and where further research is required. Armed with the information given in the preceding section the forest rangers can enter upon this task with confidence.

The section on the "Ecology and Classification of the Beech Forests" summarizes the results of the author's studies for nearly forty years. Details are first given of the ecology of the individual species, so far as it is known, but certain gaps in our knowledge—*e.g.*, the phenomena and causes of seasonal variation in flowering and fruit-setting—are indicated. Dr. J. S. Yeates has provided some information concerning the fungi investing the rootlets of southern-beech, but obviously much remains to be done, and the whole matter of root structure and distribution in relation to the growing-place of the plants awaits further investigation. The fundamental importance of the light-factor is insisted on, and is graphically illustrated (Fig. 18) by a photograph of sections of saplings of *N. Menziesii* growing within and without the forest.

An important subsection traverses the various factors governing the beech forest, its establishment and distribution—rainfall, wind, soil, temperature, altitude, the historical element (an interesting but contentious subject, here briefly glanced at), light, soil, plant-competition, indigenous animals, and introduced grazing and browsing animals. A photograph (Fig. 20) showing tussock-grassland at Hanmer replacing mountain-beech forest after burning is almost a replica of what the reviewer has seen in mountain-beech forest near Tophouse (Nelson), but there the replacement has been by way of fell-field with great mats of *Celmisia sessiliflora* and *C. spectabilis*, with other subalpine plants. So completely has the forest dis-

conclude one was on a nearly virgin subalpine fell-field. The significance of such observations in connection with reafforestation will not be overlooked. Certain points discussed—*e.g.*, the grazing and browsing animal factor—have a bearing on pastoral problems met with by those having runs in southern-beech country. So, too, from this point of view, one could wish for a fuller treatment of "wet" and "dry" forest, so important for those converting southern-beech forest into grassland, though that does not properly concern the purposes of this monograph.

The discussion of the "Composition, Structure, and Ecology of Beech Forest" has an especial appeal to the general student of forest-ecology, and will be read with great interest by botanists abroad as well as in New Zealand. The reviewer would stress its importance for practical forest management. It would be a grave mistake to pass it over as merely of technical botanical interest, a misconception our Forest Service is clearly not under. No forester should remain content till he can identify with reasonable surety the components of the forest other than the obviously economically important trees. Not till he has such a knowledge can he learn the lessons that the forest has to teach. Here it may be pointed out that those groups of plants, the mosses, liverworts, and lichens, are referred to only in a very general way. But there is not the slightest doubt that so far from being plants merely for the enthusiast to amuse himself with, they are of the most vital importance for a thorough study of the life-history and economics of the forest. In the present state of our knowledge no more could be expected than the author has here given, but now that the proper study of our mosses has been made possible by the labours of the eminent specialist H. N. Dixon, and that specialists in other groups are prepared to lend assistance, it is not out of place to urge on the officers of the Forest Service the necessity for active work on these neglected groups. Nor should it be concluded that sufficient is known on any of the topics discussed (an idea that the author of the monograph would be the first to repudiate). The reviewer's own few excursions, for instance, to the Ruahine Mountains, have impressed on him the fact that much remains to be done before the southern-beech forests occurring there can be said to be at all well known.

The subsection "Regeneration of Beech Forest" is, as the author states, "perhaps the most important portion of this monograph." All concerned should study it closely, and pastoralists will here find much that concerns their activities. Any one who has seen the results of attempting to grass much of the southern-beech country of the North-west Nelson Botanical District will do well to ponder the remarks (page 60) on the results of burning, grassing, and grazing in the Upper Maruia Valley. Much still remains to be learned, doubtless, in regard to regeneration, but it is certainly correct to state (page 58) . . . "two points stand out clearly: (1) *That all the species of* Nothofagus *require for their rapid development more light than is provided by the average forest canopy*, and (2) *that development in full light outside the forest is at least about three times as rapid as in even a well-lit forest interior.*"

The bulletin concludes with a concise summary, followed by two maps showing the author's revised botanical districts. These maps are important for all botanists, over and above their special value for the monograph.

Not the least of the merits of the work is the fact that it will serve as a model—not by any means to be slavishly followed—for other workers, both in and out of the Forest Service. It is to be hoped that Part II, dealing with the application of the results here given and the exploitation of the forests, will be issued in the immediate future. It will certainly be eagerly awaited.

In the introduction the author has stated: "In addition to furnishing material for silviculture I have endeavoured to make this monograph of value for forestry students, including in that term not only those going through a course at the University, but those departmental officers (*e.g.*, the rangers) whose duties are intimately connected with the indigenous forests, as also such of the public as are interested in forestry and the open-air study of plants." To the reviewer these objects appear to have been achieved to a remarkable degree, and the tribute paid by the author to the zeal and enthusiasm of the forest rangers augurs well for the future of the Forest Service.

H. H. ALLAN.

New Rabbit District.—The constituting of the Mangare Rabbit-proof Fencing District (Auckland), for the purposes of Part IV of the Rabbit Nuisance Act, is gazetted.

WEATHER RECORDS: APRIL, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather of the first three weeks of April, particularly over the North Island, was in strong contrast to the conditions prevailing during the last week. Fair weather, under anticyclonic conditions, was experienced until the 22nd, when barometric pressure decreased for the advent of an extensive area of westerly low pressure, with a humid and unsettled atmosphere.

There were traces of three areas of low pressure passing to the south of New Zealand, while the barometer stood fairly steady at about 30·4 in. for an unusually long period in the North.

Rainfall was below the average for April in all parts of the Dominion, except in Westland.

Easterly breezes were prevalent during the time of the anticyclone, and conditions were generally calm, sunny, dry, and mild. The break in the weather, with strong westerly winds, during the latter part of the month was very welcome and beneficial in most parts, but insufficient rainfall is still recorded in the east-coast districts, especially of the North Island.

—*D. C. Bates, Director.*

RAINFALL FOR APRIL, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	2·14	8	1·54	3·55
Russell	1·78	6	1·04	3·39
Whangarei	1·70	8	1·11	4·95
Auckland	1·56	11	0·56	3·46
Hamilton	2·76	9	1·50	3·64
Kawhia	3·09	7	1·22	4·75
New Plymouth	2·93	12	0·77	4·54
Riversdale, Inglewood	4·90	13	1·24	8·39
Whangamomona	4·41	10	1·14	6·68
Tairua, Thames	2·86	8	1·80	5·88
Tauranga	1·39	10	0·58	5·08
Maraehako Station, Opotiki	1·42	11	0·56	5·22
Gisborne	1·00	5	0·58	4·20
Taupo	1·35	5	0·46	3·95
Napier	0·34	5	0·21	2·92
Maraekakaho Station, Hastings	0·09	4	0·05	3·14
Taihape	2·35	8	0·69	3·15
Masterton	1·52	6	1·08	3·04
Patea	1·20	8	0·53	3·95
Wanganui	0·87	5	0·31	3·59
Foxton	1·68	6	0·52	2·57
Wellington	1·46	7	0·84	3·84
South Island.				
Westport	6·90	21	1·23	6·50
Greymouth	9·37	17	1·90	8·83
Hokitika	10·06	20	1·61	9·38
Ross	15·92	19	2·18	12·55
Arthur's Pass	13·41	14	2·83	17·64
Okuru, Westland	16·56	19	2·22	13·67
Collingwood	5·25	14	1·46	8·07

RAINFALL FOR APRIL, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Nelson	1·59	9	0·58	2·93
Spring Creek, Blenheim	0·55	4	0·30	1·91
Tophouse	4·06	9	1·10	4·03
Hanmer Springs	0·32	4	0·15	3·12
Highfield, Waiau	0·30	3	0·24	2·85
Gore Bay	0·73	5	0·27	2·02
Christchurch	0·79	10	0·24	1·97
Timaru	1·00	9	0·34	1·51
Lambrook Station, Fairlie	0·89	6	0·21	2·00
Benmore Station, Clearburn	1·20	9	0·44	2·52
Oamaru	1·14	8	0·31	1·78
Queenstown	2·59	11	0·68	2·92
Clyde	1·42	9	0·58	1·34
Dunedin	1·24	14	0·58	2·82
Wendon	1·91	9	0·76	3·36
Gore	1·65	15	0·26	3·29
Invercargill	3·74	20	0·54	4·36
Puysegur Point	9·69	20	..	7·98

WINTER FARM-SCHOOL ITINERARIES.

A GENERAL programme of the Agriculture Department's short courses of instruction for farmers in the various districts this winter was published in last month's *Journal.* Itineraries of the "travelling" schools to be held in June and July are now available as follows :—

Otago.—Owaka, June 7th and 8th ; Tapanui, 9th and 10th ; Alexandra, 11th and 12th ; Oamaru, 14th and 15th.

Southland.—Invercargill, June 16th and 17th ; Gore, 18th and 19th.

Marlborough and Nelson.—Blenheim, June 21st and 22nd ; Havelock, 23rd ; Richmond, 24th and 25th (tentative dates).

Northern Hawke's Bay and Poverty Bay.—Wairoa, June 28th and 29th ; Gisborne, June 30th and July 1st.

Manawatu, Southern Hawke's Bay, and Wairarapa.—Levin, July 12th ; Palmerston North, 13th ; Feilding, 14th ; Dannevirke, 15th ; Masterton, 16th ; Martinborough, 17th.

Westland.—Centres for this school—to be held between July 19th and 24th—will be announced later.

FORESTRY LEAGUE COMPETITION FOR JUVENILES.

THE New Zealand Forestry League is offering prizes for collections of the foliage, flowers, and fruit of native trees, for boys and girls (1) over twelve and under sixteen years, (2) under twelve years—three prizes in each class. Specimens are to be of not less than twelve different trees. All collections of merit will be exhibited at the annual meeting of the League. Collections must reach the Secretary, New Zealand Forestry League, Dominion Farmers' Institute, Wellington, on or before 12th June. All particulars of prizes, conditions, &c., may be obtained from the Secretary.

Autumn and early winter top-dressings of phosphate give tone to the grass, and so to the heavy-in-calf cow.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

STAGGERY AND PARALYTIC CONDITION IN PIGS.

N. McLeod, Te Kopuru :—

My young pigs, about five weeks old, are developing what we call "staggers" pretty badly. They are going in the hind quarters, but otherwise appear quite healthy. I would be very pleased if you could advise me of a remedy for this complaint, as it is fairly general throughout Northern Wairoa.

The Live-stock Division :—

This "staggery" and paralytic condition in pigs is frequently met with, and is believed to arise through error in dieting, coupled very often with bad housing-conditions. Seeing that your affected pigs are quite young, they will still be on the mother, but may be getting a little feed from the trough. If you are feeding sour milk it is to be expected that the young pigs will get indigestion, followed by other troubles. Continual feeding on sour milk or skim-milk alone is a common cause of digestive derangement. A sow which is suckling her young should have the milk supplemented by boiled roots and pollard, or some equivalent meal or grain. Keeping pigs on concrete floors without a plentiful supply of warm, dry bedding, or in wet and draughty sties, is doubtless a very important contributing cause of this form of paralysis. All swill-tubs and food-receptacles should be regularly scalded out with boiling water. Medicinally, you might give the pigs a small tablespoonful of castor-oil ; and a teaspoonful of baking-soda added daily to the sow's food would probably prove beneficial. But unless all bad conditions of feeding and housing are rectified the use of medicines will undoubtedly be of no avail.

CONTROL OF DODDER IN CLOVER AND LUCERNE.

F. Bradley, Cromwell :—

I have some clover and lucerne paddocks infested with dodder. Could you advise me as to the best method of getting rid of it without ploughing, fallowing, and cultivating ? Is it any use applying arsenic to the infected places ?

The Fields Division :—

The best method of control, apart from eradication by ploughing and cultivation, is to cut the infected areas, fairly close to the crown of the plants, to about a yard out from the actual seat of infection, before the dodder seeds. Rake the cut stuff into heaps and mix it with dry straw or litter and burn it. Repeat the treatment if necessary. The dodder can also be controlled to a lesser extent by close grazing. This applies more in the case of clover, as lucerne will not stand very close cropping. The best stock for this purpose are sheep. Arsenic dressings could be applied to infected areas, but this method would entail much extra fencing-off, &c., or the complete spelling of the paddock for some time. Besides, it is a somewhat dangerous practice, as stock are liable to be poisoned for some considerable time after treatment. We therefore would not recommend the latter method, but would give preference to either or both of the first-mentioned methods —for clover, close grazing by sheep ; and for lucerne, cutting and burning the infected herbage.

CONTAGIOUS STOMATITIS IN LAMBS.

W.N., Okoia :—

Could you advise any cure for sore lips and mouth in lambs ? The lips are deeply cracked, swollen, and bleeding. Some of the lambs also have a very sore nose, with skin all rubbed off and quite raw. Affected animals very soon fall away in condition, as it seems almost impossible for them to eat.

The Live-stock Division :—

The condition affecting your lambs is known as contagious stomatitis. This trouble is best treated as follows: Separate all affected animals from the healthy ones; wash the affected parts with a weak antiseptic solution, removing all dirt, discharge, &c., and then apply boracic or sulphur ointment. The ointment should be applied daily until recovery takes place. A change of feed is essential.

HAZEL AND WALNUT TREES.

A. C. HARRISON, Tauranga :—

Would hazel-trees make a hedge—not necessarily a trimly kept one; and would stock damage the plants by nipping off the shoots over a fence? Would establishment be with young plants or from cuttings? What treatment of soil should be given, and what length of time would it take for the trees to bear? Also, what length of time do walnut-trees take to bear? Should they grow fairly well here? It is rather windy where we are situated. Could you recommend one or two good commercial varieties?

The Horticulture Division :—

Young hazel-trees are best obtained from a reliable nursery and planted out in moist land that is of medium quality only. Planting on good land, as is usually done, results in strong vigorous growth with very few nuts. With proper treatment the trees should commence to bear in five or six years. So many kinds of trees and shrubs are sometimes injured by cattle browsing on them from over a fence that it is best not to take any risks, but plant them at a safe distance. While the hazel-nut is often planted as a hedge or screen, one rarely finds it cropping well under such circumstances. It requires to be pruned and trained in an open manner for that purpose, which usually renders it unsuitable as a hedge. Walnut-trees require a good, well-drained, alluvial soil, and suitably worked trees should commence to bear in eight or ten years. Franquette, or a well-selected variety of the English walnut, should suit your purpose.

ABORTION FOLLOWING BLOATING IN COW.

"SUBSCRIBER," Otane :—

I have had a number of cows badly bloated on lucerne this season, and had to knife several as a last resort. In the last case I used a trocar, allowing it to go in the full depth. About ten days later the cow aborted, about four or five hours after milking, there being no sign of anything unusual then. The calf would be five months. Do you consider this a case of abortion (contagious), or merely the after-effects of bloating through the animal being injured internally, so causing the calf to die?

The Live-stock Division :—

We do not consider that the abortion was due to the contagious disease in this case. Abortion following acute bloating in pregnant animals is not uncommon —in fact, is a recognized sequel to the tympanitic condition.

FORTHCOMING WINTER SHOWS.

Franklin A. and P. Association: Pukekohe, 28th and 29th May.
Otago A. and P. Society: Dunedin, 1st to 4th June.
Waikato Winter Show Association: Hamilton, 1st to 5th June.
Auckland Winter Exhibition: Auckland, 9th to 19th June.
Manawatu A. and P. Association: Palmerston North, 15th to 19th June.
Wanganui A. and P. Association: Wanganui, 24th to 26th June.
South Taranaki Winter Show Company: Hawera, 30th June to 7th July.
Wellington Show Association: Wellington, 10th to 24th July.

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A RECONNAISSANCE SURVEY OF PUMICE SOILS.*

ROTORUA COUNTY.

(Continued.)

B. C. ASTON, F.N.Z.Inst., Chemist to the Department of Agriculture.

IV. SOIL-TYPE BOUNDARIES MAPPED.

THE soil survey of Rotorua County has now reached a stage where it is possible to show on the northern half of the county map the several types of soil which occur and, roughly, to map the boundaries of the types.

The work has been of a most arduous nature owing to the comparative lack of settlement and therefore of means of access, a large part of the area being still under native vegetation. Further, a part of the area is heath country of no agricultural value, in which thermal activity is preventing the growth of anything in the nature of forest, as only the most xerophytic (capable of resisting abnormal soil conditions) plants can exist. A topographical survey is at present being carried out by the Lands and Survey Department, and when the results of this are available it will be possible to prepare a soil map in very much greater detail. At present one must be content with working with a county map on the scale of one mile to the inch.

Pumice soils—by which is meant soils chiefly and obviously consisting of pumice—vary greatly in their quality, which is governed by their texture. This ranges from those soils and subsoils which are so coarse that they must permanently remain as desert, heath, or forest land, to those which are so fine or so compacted that they may be profitably utilized in the grazing of sheep and cattle. Probably all the difficulties in settling coarse pumice lands will be traced to the deficient water content of the soil in spite of the 60 in. to 70 in. of rain which falls annually. Pumice is a word which is supposed by etymologists to be related or derived from the same root which gives spume (spuma-foam). Pumice is, indeed, a solidified foam or volcanic froth and highly absorbent. One finds pumice in all stages of decay, of comminution, and of compaction. It had probably been well leached

* For previous articles of this series see *Journal* for November and December, 1924, and January, 1925.

before being redistributed to positions in which it is now found. The final stage of decay or chemical change as pumice is where the fine lumps have become so acted upon by natural agencies that the resultant mass is quite plastic with very little feeling of grittiness. The final stage of comminution is when the pumice is reduced to a fine sand or silt. The final stage of compaction is found in river-terraces in which the weathered and powdered material is laid down into a wonderfully fertile alluvial soil. Soils of all these grades may be found, and some may be termed improved pumice lands, where improvement has gone on to such an extent that farming may profitably be carried on without resorting to exceptional methods.

These studies are for the present limited to the soils derived from the "Rotorua Pumice Shower" and other more recent eruptions in Rotorua County. There are many areas of pumice lands derived from other outbursts possibly of different age, origin, and composition, which may therefore not be comparable with that of the Rotorua Shower. These must be studied separately in their turn. A warning should be given against the practice of speaking of all pumice soils as a class without limitation or definition. To make general statements disparaging to pumice soils is to court disproof by hundreds of successful farmers on what may justly be called pumice lands. It is, on the other hand, dangerous to extol pumice lands indiscriminately as fields for settlement, for instances may readily be given of large areas which are not suitable for settlement by the methods in common use. Seeing that there is this great diversity of soils under the term "pumice," it will be conceded that some scheme of classification must preclude an intensive study of the subject, and the initial step in this direction is exactly what a soil survey of the Rotorua County hopes, among other things, to accomplish.

For a discussion on soil surveys the article in this *Journal* for September, 1923, "The Ideals of a Soil Survey," should be consulted. One may here merely recapitulate that the largest unit used in classifying soils in the United States of America is the "soil province," of which there are some fourteen in that country. A soil province may owe its individuality either to geographical position or to geological origin. A minor unit of subdivision is the "soil series," embracing soils of a common origin which differ only in texture (fineness). The smallest unit is the "soil type," which distinguishes between soils of the same series. It is proposed tentatively to regard all soils consisting obviously mostly of air-borne materials derived from the North Island Volcanic Plateau as a soil province. This is a province for the greater part based on geological origin.

The enormous extent of country overlain by the pumice from this area is the subject of remark by all geologists who have traversed the country. Hill ("Pumice, Its Geological Distribution on the East Coast of North Island of New Zealand," *Trans. N.Z. Inst.*, p. 293, vol. 20, 1887) shows that pumice-beds extend from Cape Turnagain in the south to Tolaga Bay in the north, and that pumice covers the Ruahine, Kaimanawa, and Te Whiti Ranges. An area of 5,000 square miles has been affected directly or indirectly by ejectamenta from the Central Plateau. Hill, indeed, in his paper read before the Hawke's Bay Philosophical Institute, says: "I have often thought that a good deal might be said in support of the claims of pumice as being the origin

in this district at least of most of the fertile soils." He publishes a sketch-map showing the distribution of pumice of three different ages.

Jameson (*N.Z. Journal of Science and Technology*, vol. 2, p. 209, 1919, "Technical Analysis of Auckland Clays") states that it is probable that the material of the clays under consideration was brought down by the Waikato River, and is the product of decomposition of the rhyolitic pumice occurring in the upper portions of the Waikato Basin. He points out that the formation of clays from rhyolitic glass has not yet been recognized in literature. He gives an instance of the alteration of the rhyolite on Rainbow Mountain, Waiotapu, by local solfataric action into white plastic clay having the composition of pure kaolin. The present writer has noticed lumps of what were obviously once pumice in a cutting near Otanewainuku, which had completely lost their pumiceous character and on gentle pressure were reduced to a plastic mass.

McKay (1899, "Report on the Pumice-stone Deposits of the Middle Part of the North Island: Geological Explorations," pp. 16–25, parliamentary paper C.–9) published a comprehensive paper on the distribution of pumice. He concludes: "Whatever its source, the quantity of pumice distributed over the middle part of the North Island, from Ruapehu to the shores of the Bay of Plenty and the upper end of the Hauraki Gulf, in the middle and lower Waikato and east and west from the sources of the Waipa to the east coast and Hawke's Bay, is enormous, and may well excite curiosity and prompt speculation as to the origin of the same." One can only surmise that if the pumice has influenced the formation of soil as far north as Auckland City, as far east as Tolaga Bay, and as far south as Cape Turnagain, it must be much more responsible for the origin of the fertile lands nearer the source of eruption, and may well be the greatest single soil-former in the North Island, and, as such, worthy of all serious study.

The present writer can confirm what he has quoted from actual experience in his explorations of the Ruahine, Kaimanawa, and Kaweka Mountains. These have been covered in many parts with a deposit of pumice of varying thickness. The pumice has been washed off the mountains and has filled the gullies in many cases, and the rivers have again eroded their beds through the pumice, leaving high terraces of pumice boulders, gravel, sand, and silt. A systematic search of the literature would doubtless show many other instances of the widely spread area affected by pumice, which has evidently influenced a very great area of the North Island land apart from the portion known as the Volcanic Plateau. The present writer is confident that the ultimate future of pumice lands which are now growing or have recently grown forest is exceedingly hopeful, but an intensive study of the areas which have grown nothing better than scrub—manuka (*Leptospermum scoparium*), kanuka (*L. ericoides*), or monoao (*Dracophyllum subulatum*)—is required before anything can be said of the agricultural possibilities of such soils.

A very distinct series of soils is easily identified in Rotorua County as that derived from the Rotorua Shower (Thomas, 1888, "Report on the Eruption of Tarawera and Rotomahana, N.Z.," p. 19). This series (A) owes its individuality entirely to geological origin and

consists of rhyolitic pumice. The types so far recognized and mapped of this series, arranged in the order of their relative coarseness, are,—

(1.) Fine gravelly and coarse sands, Rotorua lakeside.
(2.) Fine gravelly sands, Kaharoa (thirty-six square miles).
(3.) Intermediate between (2) and (4).
(4.) Coarse sandy silts, Te Pu.
(5.) Sandy silts, Rotorua and Mamaku (one hundred and thirteen square miles).
(6.) Sandy loam, Oturoa (twelve square miles).

In Series B there is a very large extent of country of a very uniform composition, consisting mostly of coarse sands and some sandy silts, but containing a proportion of basic material consisting of black scoria (andesite). This is probably material derived from an earlier source than the Tarawera eruption of 1886. These soils lie to the north and north-east of Lake Rotorua and extend out towards the Bay of Plenty.

Series C contains two types—(1) a sandy loam, (2) fine sandy loam. These are derived from the 1886 Tarawera eruption and lie to the east of Lake Rotorua. They are the most fertile and healthy lands in the district, and are remarkable compared with other soils of this district in containing a large proportion of lime soluble in hydrochloric acid; but, as the soil does not effervesce, the lime is therefore not in the form of carbonate but silicate. It will be noticed that generally the finer the texture, as shown by the analysis and volume weight, the healthier the country.

DETAILED CHARACTERS OF THE SOIL TYPES (SEE TABLES).

Series A.

Type 1: These soils are the healthy* lakeside soils which are often submerged and normally are only a few inches above stagnant water. Such a soil is often abandoned to self-sown grasses and clovers, and grows a rank pasture of sedge (*Carex*), Yorkshire fog, and other grasses not favourably recognized as possessing high value on the farm. Stock nevertheless thrive greatly on these lake-flats. The soils are often extremely coarse in texture, but the bad results of this are mitigated by the high water-supply.

Type 2: These are fine gravelly sands of the Kaharoa and Te Pu districts. They are the worst and most unhealthy of any soils met with in the survey. Coarse in texture, they are very often spread over high ridges, and the difficulty of watering stock has to be met by the erection of concrete tanks—often extremely inadequate. Kapakapa Road traverses a typical area of the worst type, but towards the road's end the soil improves, inasmuch as the percentage of pumice decreases and the percentage of denser ejected material increases. The natural vegetation of this area is forest similar to that of the Mamaku sandy silts (Type 5)—tawa-rimu forest, modified, however, by the inclusion of trees requiring milder climatic conditions, such as mangeao (*Litsaea calicaris*) and kohekohe (*Dysoxylum spectabile*). The weight of a cubic foot of moist soil taken under conditions comparable with the other types is 68·75 lb.

Type 3: This is a strip of intermediate material, possibly a mixture of Types 2 and 4.

Type 4: Coarse sandy silts of Te Pu. Is probably a small area of intermediate country with similar flora to Type 2.

Type 5: These are the sandy silts of Rotorua and the Patetere Plateau round about Mamaku. They are the largest of all in extent in this area here dealt with. This type has two distinct plant-coverings. On the highest lands, 1,760 ft. above sea-level, on the plateau the growth is forest of the tawa-rimu type, which is unhealthy country; but as one descends the plateau to the crateriform depression in which the Town of Rotorua is situated, tutu (*Coriaria*) and fern (*Pteridium*) become the native covering. This land can easily be made healthy by treatment. There is no physical difference in the soil. The lower altitude of the Rotorua lake-terraces and possibly proximity to a large body of water give that area a more genial climate, and the natural covering of fern makes the task of breaking in the country much easier.

FIG. 11. TYPICAL RIMU-TAWA FOREST, PATETERE PLATEAU.
Wineberry second growth in foreground.

In the fern land are no stumps for the rotting of which the farmer has to wait twenty years before he can get the plough in; consequently he starts with the advantages given by ploughing, fertilizing, and cropping the soil. After a burn on forest country it is extremely arduous and costly work extracting the stumps even after twenty years. Weight of cubic foot of moist soil, 75·47 lb.

Type 6: The origin of the sandy loam area of Oturoa is somewhat of a mystery. Situated in the midst of air-borne sandy silts bearing the typical tawa-rimu forest of the kind most resistant to climatic severity, one comes across an area of much heavier soil, carrying a forest which consists largely of two species of beech (called "birch" by the settler)—red-beech (*Nothofagus fusca*) and silver-beech (*N. Menziesii*). There is every reason to think that this area would produce a pasture, and from it stock which would not suffer from iron-hunger (bush sickness). It will be seen that the physical composition of this area

TABLE 7. MECHANICAL ANALYSES.

(Results are percentages on air-dried soil.)

Laboratory No.	Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.								Stones and Gravel.	Remarks.
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.	Loss on Ignition.		
Series A. Rotorua Shower Series, containing no Basic Scoria.											
1. Fine Gravelly and Coarse Sands, Lakeside.											
S 490	Fine gravelly sand ..	22·6	55·8	9·3	3·8	2·1	1·1	0·6	5·0	35·4	Lakeside paddocks, Ngongotaha. Lake-terrace soil.
2. Fine Gravelly Sands, Kaharoa.											
T 562	Fine gravelly sand ..	18·3	44·8	10·6	9·6	4·2	1·3	2·2	9·5	5·3	Dudley Road, Te Pu. Forest on ridge.
564	" ..	23·2	46·6	9·9	8·7	3·5	0·9	1·4	6·5	Trace	Dudley Road, Te Pu. Fern slopes.
566	" ..	22·3	40·2	14·0	9·6	3·6	1·0	1·4	7·7	7·7	Dudley Road, Te Pu. Lower slopes, fern and grass.
568	" ..	17·3	37·8	17·9	12·5	4·6	1·0	1·0	7·4	4·5	Dudley Road, Te Pu. Higher level area, old grassed clearing.
616	" ..	26·3	26·6	16·1	12·9	4·4	1·2	5·2	9·0	11·1	Kaharoa Road. Fern flat.
618	" ..	23·8	35·5	13·9	10·4	3·3	0·7	3·9	8·5	5·3	Rotongata Road, Kaharoa.
620	" ..	20·3	49·0	11·3	8·5	3·0	0·5	1·1	6·2	7·4	Junction, Rotongata and Te Waerenga Roads.
622	" ..	35·0	26·1	12·1	9·9	4·0	0·7	1·7	10·9	12·5	Te Waerenga Road. Fern and grass.
624	" ..	32·2	23·3	12·2	10·2	3·8	0·7	7·7	7·9	14·8	Te Waerenga (half-mile from road). Poor grass.
S 472	" ..	16·6	40·2	14·3	10·5	5·4	1·1	2·5	9·2	12·8	Kapakapa Road, Kaharoa.
T 64	" ..	18·1	40·9	12·3	10·1	7·5	1·2	1·8	7·4	15·4	Block VI, Rotoiti S.D.
176	" ..	21·5	53·4	7·5	5·4	3·8	1·1	1·3	5·1	11·8	Blocks VII and VIII, Rotoiti S.D.
S 475	" ..	16·7	48·7	12·0	8·8	5·0	0·8	0·8	7·1	9·2	Kaharoa. End of Kapakapa Road. Contains less pumice and more volcanic glass.
3. Intermediate between Coarse Sandy Silts and Fine Gravelly Sands, Kaharoa.											
T 806	Between coarse sandy silt and fine gravelly sand	16·3	31·8	20·0	14·3	4·3	0·8	1·3	9·9	5·9	Kaharoa Road, near junction Main Road.
529	Ditto	22·2	24·9	14·8	13·7	4·8	1·6	3·3	13·5	16·0	Pasture, Hamurana.
570	"	22·7	29·0	14·5	12·5	5·1	1·3	2·8	7·8	8·7	Kakahi Village. Rough pasture, fern and blackberry.
572	"	20·4	33·1	16·3	15·1	3·9	1·5	1·1	8·7	7·5	Junction, Rotorua and Roy Roads, Te Pu. Rimu-tawa forest.
580	"	18·1	34·3	18·1	12·3	7·1	0·9	0·9	8·4	9·1	Lagoon Road, Te Pu. Rimu-tawa forest.
582	"	27·3	29·9	12·2	13·1	5·8	1·8	1·3	7·8	Trace	Lagoon Road. Rimu-tawa forest.
592	"	16·3	36·4	18·9	14·3	5·2	1·2	1·5	6·2	5·5	Dudley Road, Te Pu. Grass flat.
612	"	23·3	28·6	13·8	13·2	5·3	1·3	3·4	10·5	7·4	Tauranga–Rotorua Road, Te Pu. Good pasture.
627	"	23·1	27·0	17·6	11·1	4·6	0·8	4·6	10·9	9·5	Te Waerenga Road, Kaharoa. Forest.
S 469	"	14·7	35·1	17·9	13·0	5·0	3·1	2·4	9·2	16·8	Kaharoa, above Hamurana.

4. Coarse Sandy Silts, Te Pu.

S	478	Coarse sandy silt ..	6·3	46·6	15·3	12·8	6·1	1·1	1·2	9·0	5·5	Tauranga Road, one mile beyond Ngawaro, on Main Road.
T	531	,, ..	13·9	27·0	15·1	11·9	5·5	1·2	11·7	13·1	13·6	Hamurana. Hillside.
	584	,, ..	15·1	34·1	16·1	13·1	5·8	1·7	1·4	11·6	4·2	Junction, Scenic and Rotorua Roads, Te Pu. Grass.
	586	,, ..	11·3	38·9	18·1	12·6	5·6	1·1	3·5	8·8	4·3	Junction, Rotorua and Puwhenua Roads, Ngawaro.
	590	,, ..	14·5	38·6	16·4	12·3	6·8	1·1	1·6	8·5	4·8	Puwhenua Road. One mile from Main Road, Ngawaro.
	517	,, ..	3·0	34·0	27·6	15·8	3·4	0·5	3·2	12·3	2·2	Ngongotaha Mount Road. Fern.

5. Sandy Silts, Rotorua and Mamaku.

S	454	Sandy silt	1·2	25·2	25·6	19·1	6·3	3·6	4·5	13·4	9·4	Mamaku, Section 10, Block II, Horohoro S.D.
	504	,, ...	1·2	25·3	23·0	18·3	7·8	3·5	4·3	14·8	2·9	Mamaku, Section 10, Block II, Horohoro S.D.
	458	,, ...	0·9	19·2	26·6	20·6	6·9	3·3	4·1	16·9	5·4	" Kaharoa Clearing," Matamata County.
	462	,, ...	1·3	20·3	25·5	19·4	6·5	3·9	6·2	15·0	5·1	Lichfield.
	493	,, ...	16·8	30·5	17·3	17·7	6·9	3·9	0·7	6·4	35·5	Te Ngae. Lakeside. Probably washed subsoil is a sandy loam.
T	497	,, ...	3·2	19·9	22·2	19·7	8·3	2·1	8·5	14·9	5·3	Oturoa Road, towards Rotorua.
	533	,, ...	3·1	31·3	24·7	17·0	5·9	1·3	5·7	10·9	Trace	Hamurana, Rotorua district.
	535	,, ...	2·6	22·1	25·7	21·2	9·4	2·1	2·0	12·9	5·3	Mamaku, Section 1, Block XIII, Rotorua S.D.
	537	,, ...	1·9	24·9	25·2	19·8	7·3	3·7	2·9	13·9	Trace	Mamaku, Section 1, Block XIV, Rotorua S.D.
	539	,, ...	1·5	21·0	25·0	19·3	7·6	3·1	8·9	12·9	6·0	Mamaku-Lichfield Road, Section 1, Block X, Rotorua.
	541	,, ...	2·1	20·5	23·2	20·3	9·0	3·2	5·8	14·2	4·5	Tirau-Rotorua Road, Section 2, Block X, Rotorua.
	543	,, ...	1·7	20·9	25·1	20·0	7·0	3·4	4·0	16·5	10·5	Rotorua-Lichfield Road. One mile from Tarukenga Station.
	545	,, ...	3·1	21·6	22·4	23·0	7·3	2·2	3·4	14·9	Trace	Tarukenga Station.
	578	,, ...	12·2	26·8	19·4	14·1	6·9	2·2	4·8	14·5	2·4	Edge of Mangorewa Block, Te Pu.
	554	,, ...	2·8	29·7	21·8	15·8	6·3	1·2	6·6	14·7	Trace	Clayton Road, Rotorua. Terrace, 1,475 ft.
	556	,, ...	2·7	20·8	24·3	21·3	7·4	1·1	4·5	16·5	Trace	Clayton Road, Rotorua. Terrace, 1,675 ft.
T	558	,, ...	2·2	22·7	25·9	22·1	7·7	1·4	5·0	12·4	6·6	Rimu-tawa forest, Rotorua. Clayton Road, 1,500 ft.
	560	,, ...	3·7	25·4	26·0	22·6	6·1	1·1	1·7	12·6	8·0	Grass flat, Rotorua. Clayton Road, 1,350 ft.
	574	,, ...	14·2	28·7	17·4	20·0	5·7	1·6	1·4	10·4	18·2	Junction, Te Pu tram-line and Roy Road, Te Pu. Low flat.
	576	,, ...	16·1	29·8	19·2	14·3	6·3	2·2	2·9	9·3	3·7	Junction, Roy and Lagoon Roads, Te Pu.
	588	,, ...	5·6	34·5	26·6	16·8	7·5	1·4	0·9	7·2	1·9	Puwhenua Road clearing, Ngawaro.
W	66	,, ...	4·6	34·4	21·7	15·6	8·4	1·6	3·3	10·0	11·1	East side, Mokoia Island.
	70	,, ...	3·6	20·4	25·4	20·5	7·4	2·7	3·5	15·3	2·7	Oturoa.
	71	,, ...	3·3	22·2	30·2	21·3	4·4	1·0	3·3	12·7	9·4	Junction, Oturoa and Hamurana Roads.
T	838	,, ...	3·3	28·2	27·6	20·4	4·6	0·4	2·5	11·6	2·4	Main terrace to west of Hemo Gorge, Whakarewarewa, Rotorua.
	840	,, ...	4·0	23·9	27·9	21·6	6·0	0·6	2·2	13·4	4·8	Highest part of hill, Whakarewarewa, Rotorua.
	501	,, ...	4·1	29·2	25·1	21·7	6·0	0·8	2·1	10·5	6·6	3A No. 1, IV, Horohoro S.D., near Rotorua Town.
	503	,, ...	5·3	31·0	23·1	20·7	6·1	1·0	2·4	10·0	10·0	76, IV, Horohoro S.D., near Rotorua Town.
	505	,, ...	2·7	25·4	28·5	21·3	5·5	0·9	2·8	12·7	Trace	3E No. 4 and 3B, IV, Horohoro S.D., near Rotorua Town.
	507	,, ...	2·4	27·3	28·6	20·6	3·9	1·0	3·2	11·8	2·8	No. 2M and 3C, 2A, IV, Horohoro S.D., near Rotorua Town.
	519	,, ...	0·8	26·6	31·3	17·8	4·5	1·0	3·8	12·3	2·4	Mamaku-Rotorua Road. Near bridge; flat.
	521	,, ...	2·2	29·8	27·6	16·3	4·7	0·8	3·2	13·6	Trace	Mamaku-Rotorua Road. Near bridge; ridges. Section 3, Block XV, Rotorua S.D.
	523	,, ...	2·4	23·5	26·9	18·5	8·0	0·6	2·2	17·9	12·5	Scenic reserve forest, Mamaku-Rotorua Road.
T	525	,, ...	1·7	26·1	27·3	18·9	7·3	1·7	2·6	12·8	4·5	Section 12, Block XIV, Mamaku-Rotorua Road.
	527	,, ...	3·0	26·6	24·2	19·7	7·4	2·3	2·1	13·7	Trace	Section 9, Block XIV, Mamaku-Rotorua Road.
	509	,, ...	3·4	29·8	26·2	17·0	3·6	0·7	3·9	14·4	Trace	No. 71, Block IV, Horohoro S.D., Clayton Road.

TABLE 7. MECHANICAL ANALYSES—*continued.*

	Laboratory No.	Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve. Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.	Loss on Ignition.	Stones and Gravel.	Remarks.
		Series A. Rotorua Shower Series, containing no Basic Scoria—*continued.*										
		5. *Sandy Silts, Rotorua and Mamaku*—continued.										
	511	Sandy silt	2·9	29·1	25·5	17·8	4·8	0·7	5·3	12·6	Trace	No. 1, No. 2A, Block IV, Horohoro S.D.
	513	"	2·6	26·6	26·1	19·4	6·0	0·7	3·4	13·9	Trace	No. 1M, No. 3, Block IV, Horohoro S.D.
	515	"	3·5	29·0	27·3	16·7	3·3	0·4	5·6	12·8	2·7	Ngongotaha Mount Road. Bush.
	493	"	4·1	30·9	28·0	20·9	4·1	0·9	1·8	8·5	4·5	No. 2B, No. 1, Block XII, Rotorua S.D.; Junction, Oturoa and Hamurana Roads.
	495	"	3·7	28·6	29·6	18·0	4·2	0·8	2·4	11·3	2·7	No. 2W, Block XII, Rotorua.
S	669	"	4·3	19·1	28·2	23·8	6·4	0·7	4·0	12·4	5·9	Ngongotaha. Junction of Oturoa Road.
		6. *Sandy Loams, Oturoa.*										
S	466	Sandy loam	0·8	19·2	24·2	20·9	7·0	5·0	7·4	14·0	6·3	Oturoa. Beech forest.
T	499	"	0·8	16·3	20·9	19·8	8·7	5·5	9·5	18·4	Trace	Oturoa Road, Section 10, Block X, Rotorua S.D.
W	68	Loam..	1·6	8·8	14·3	22·8	15·8	3·5	6·3	27·3	9·5	Oturoa Road, Section 10, Block X, Rotorua S.D.
	69	Neither a sandy silt nor a sandy loam, but nearer the latter	0·9	15·6	26·6	23·4	9·6	3·2	5·1	13·0	1·9	Oturoa Road, Section 8A, Block X, Rotorua S.D.
S	661	Sandy loam	1·4	18·0	23·4	20·7	10·5	4·8	4·3	16·1	Trace	Lichfield–Oturoa Road. Pasture.
	663	"	1·0	15·4	23·3	20·9	12·0	4·2	6·3	16·1	2·9	Lichfield–Oturoa Road, Section 5A, Block X, Rotorua S.D. *Nothofagus* forest.
S	665	"	1·5	18·1	22·2	23·5	7·9	5·2	5·4	15·8	Trace	Lichfield – Oturoa Road, Section 5, Block X, Rotorua S.D. Pasture.
	667	"	1·4	14·0	20·7	20·3	12·3	4·0	6·7	18·7	6·5	Oturoa. Pasture, near Waihi Tramway.
		Series B. Old Tarawera Eruption Series, containing Basic Scoria.										
		Type 1. Coarse Sands, Ngawaro–Rotoiti.										
S	498	Coarse sand	14·5	54·7	11·5	9·0	4·7	1·1	0·4	4·1	22·2	Rotoiti Station. On ridge.
	481	"	8·6	43·8	18·0	12·3	4·2	2·3	1·8	8·6	4·1	Ngawaro. Junction, Mangatoi and Main Roads.
	501	"	9·2	49·9	14·3	10·9	6·3	1·5	1·4	6·4	9·6	Rotoiti Station. Slopes of gullies.
	484	"	10·0	43·6	18·4	10·1	7·0	1·2	1·7	8·6	19·6	Matai Road. Forest.

T	72	,, ...	13·2	50·3	14·5	7·5	4·3	1·1	1·9	6·0	11·1	Block X, Rotoiti S.D.
	173	,, ...	10·0	45·9	15·3	13·1	6·0	1·4	1·9	5·5	7·1	Blocks VII and VIII, Rotoiti S.D.
	174	,, ...	14·8	43·0	14·3	12·5	4·9	1·6	2·0	5·1	10·8	Blocks VII and VIII, Rotoiti S.D.
	175	,, ...	6·9	46·3	13·9	10·4	7·3	1·3	4·2	9·4	11·1	Blocks VII and VIII, Rotoiti S.D.
	177	,, ...	7·2	54·3	17·2	9·2	5·4	1·0	0·8	5·0	5·0	Blocks VII and VIII, Rotoiti S.D.
S	178	,, ...	8·3	55·8	15·4	9·6	5·4	0·8	0·7	3·8	6·7	Blocks VII and VIII, Rotoiti S.D.
S	179	,, ...	6·9	50·4	16·3	10·1	4·4	1·1	1·9	8·3	11·8	Blocks VII and VIII, Rotoiti S.D.
	180	,, ...	5·6	58·3	13·1	8·6	5·4	1·0	1·7	4·9	6·4	Blocks VII and VIII, Rotoiti S.D.
T	596	,, ...	8·4	44·0	16·8	11·5	6·5	1·3	1·7	9·3	1·8	Otanewainuku. Flat-topped ridges, lower slopes.
	606	,, ...	9·4	47·9	15·8	9·5	6·4	1·1	1·5	8·0	2·0	Whataroa Road, Ngawaro.
	594	,, ...	10·4	48·8	11·6	12·2	5·6	0·9	2·9	7·4	Trace	Mangatoi Road, Ngawaro.
	598	,, ...	6·8	57·5	14·4	10·3	3·7	0·8	1·1	5·5	Trace	Otanewainuku. Higher slopes. Pasture.
	600	,, ...	10·0	49·4	12·2	11·6	4·9	0·7	1·8	8·3	Trace	Mangatoi Road. One mile from Main Road, Ngawaro.
	602	,, ...	10·5	46·2	16·6	12·1	5·1	0·7	1·0	7·8	2·6	Junction, Mangatoi and Rotorua Roads. Forest.
W	76	,, ...	13·7	52·6	13·1	7·8	4·5	1·1	1·3	6·2	22·0	Hongi's Track. Forest.
	78	,, ...	5·6	50·7	22·8	9·7	4·3	1·1	1·0	5·0	4·5	Rotoma S.D. Forest, near W/76.
	82	,, ...	10·3	53·1	17·0	8·4	4·7	0·7	0·7	4·8	5·7	Section 6, Block XVI, Maketu S.D. Forest.
	84	,, ...	10·1	48·1	16·0	10·9	4·2	1·3	1·4	8·0	4·0	Twelve miles from Okere towards Tauranga. Fern land.
	86	,, ...	14·0	45·0	17·1	10·6	4·9	1·1	0·8	6·5	3·2	Whataroa clearing, Matai Road. Eight miles from Main Road.
	88	,, ...	14·7	40·8	16·7	10·5	5·9	2·1	1·6	8·0	3·7	Whataroa clearing, Matai Road. One mile from Main Road.
T	604	,, ...	5·2	47·4	19·1	11·9	4·9	1·2	2·5	7·1	Trace	Whataroa Road, Ngawaro. Lower flats.
T	608	,, ...	10·5	56·5	11·8	8·3	4·7	0·4	2·2	6·5	Trace	Whataroa Road, Ngawaro. Pasture.
	610	,, ...	14·3	48·5	12·9	11·0	4·6	0·5	1·5	5·9	3·1	Whataroa Road, Ngawaro. Koromiko Clearing.

Type 2. Coarse Sandy Silts, Rotoiti.

W	72	Coarse sandy silt ..	8·5	44·5	17·9	14·0	6·0	2·1	2·0	5·5	11·7	Tikitere. Ploughed paddock.
	74	,, ..	11·5	41·9	18·9	11·8	7·3	2·2	1·1	5·1	21·3	Lake Okataina. Forest.

Series C. Recent Tarawera Eruption Series.

Type 1. Sandy Loams, Te Ngae.

W	60	Sandy loam	6·4	13·4	28·5	22·7	12·6	8·4	1·7	6·7	19·0	Wairoa Road.

Type 2. Fine Sandy Loams, Okareka.

W	62	Between a sandy loam and a fine sandy loam	5·2	13·0	36·6	22·0	12·1	6·0	1·1	3·8	40·6	Terrace by Lake Okareka. Fern, &c.
	64	Ditto	5·1	15·4	39·2	18·9	11·7	6·3	1·0	2·3	33·3	Flat by Lake Okareka. Manuka.

closely approaches that of Series C, on which malnutrition disease never occurs. There is, however, an important chemical difference in that the Series C soils (Te Ngae district) contain material which yields a higher percentage of lime than the Oturoa lands. It is quite possible that the heavier Oturoa lands would respond to a dressing of carbonate of lime, the use of which is contra-indicated by experience in the case of coarser soils. The remarkable change in the composition of the plant-covering in both forest and undergrowth (fully described in this *Journal* for November, 1924, p. 333), which is correlated with the change in composition of the soil, is a fact worth noting. It is worthy of remark that where the beech forest spreads on to lighter soil on the Matai Road the subsoil where the tree-roots would be is still a heavy one, though the undergrowth whose roots would be in the soil mostly is of the same type as that growing on Type 5. Weight of cubic foot of moist soil (Type 6), 78·35 lb.

It is to be remarked that on all the types other than Nos. 1 and 6 of Series A the nutrition disease iron-hunger or bush sickness in ruminants develops as a natural sequence on surface-sown pasture on unploughed unfertilized land, and unless remedial measures are adopted all stock will become affected.

Series B.

This series, containing the No. 1 type of coarse sand, is a very large area to the north of Lakes Rotorua and Rotoiti. Sheep sometimes become affected on this country. These lands are likely to respond rapidly to proper treatment. The native vegetation is much the same as that on Series A, Type 2. They are quickly becoming settled. Area, 120 square miles. Weight of cubic foot of moist soil, 79·49 lb.

Series C.

These consist of two soil types, but there are three types of vegetation. At the lakeside where wet conditions prevail swampy forest of the pukatea (*Laurelia*) and white-pine (*Podocarpus dacrydioides*) type occurs. On drier lands is a modified tawa-rimu forest, and interspersed with this, in a fashion which suggests old Maori clearings, fern and tutu largely predominate. Area, twelve square miles. Weight of cubic foot of moist soil, 85·81 lb.

GENERAL.

The map which accompanies this article is but a preliminary map of the soils. It does not pretend at present to be a map showing the incidence of bush sickness, although with further investigation and inquiry it may well develop into such. A map of the subsoils is in course of preparation.

In the carrying-out of the work here recorded the writer wishes to acknowledge the zealous and able assistance of Mr. R. E. Grimmett, M.Sc., of this Laboratory, who has been in charge of the mechanical analyses and has designed apparatus for quickening the work (*N.Z. Journal of Science and Technology*, vol. 8, No. 2, 1926). Mr. Grimmett is to be stationed in the Rotorua County for some months in order to extend this survey into areas adjoining those already covered.

(To be continued.)

DISEASES IN FLOCKS AT LAMBING-TIME.

HINTS FOR SHEEP-FARMERS.

W. C. BARRY, M.R.C.V.S., District Superintendent, Wellington.

THE approach of the lambing season, with its concomitant troubles in ewe and lamb, suggests that reference to the commoner causes of mortality at this period might prove helpful to sheep-farmers by reminding them beforehand of the methods of prevention of such losses. The suggestions contained in the following notes are mostly a reiteration of the advice issued in past years on the subject by the Live-stock Division.

CONDITION OF THE EWE.

On the ewe's physical condition previous to the time of parturition depends to a great extent her ability to bring forth healthy lambs with a minimum of risk to the ewe herself. Indeed, if we exclude climatic conditions giving rise to mortality which cannot be avoided, and certain obstetrical difficulties met with occasionally which end in death, it will be found that by far the greatest loss is occasioned by a condition of the ewe not consistent with fitness during the weeks preceding lambing.

By fitness in the ewe is meant a state of constitutional vigour not impaired by excess of fat. This ideal condition can be obtained only through a properly regulated diet and sufficient exercise. By these means the natural tendency of the pregnant ewe to lay on too much fat is checked, and she arrives at parturition not in a plethoric state, but in sound, hard condition. Dietary plays an important part in sheep diseases, and in no instance more so than in the case of the pregnant ewe. If feed be too plentiful a close watch must be kept and the ewes changed to barer pasture, where the enforced exercise in obtaining sufficient feed will have its beneficial results. Forcing in-lamb ewes with too much dry feed—chaff, hay, &c.—brings about bad effects by producing high condition and consequent loss of exercise. Again, feeding turnips indiscriminately must be guarded against. Briefly, the desired end is obtained by variety and change of feed —" doing " the ewes wisely but not too well.

ANTEPARTUM PARALYSIS.

This is a common cause of mortality among ewes, more often seen in seasons when the conditions of feed favouring its development obtain. The predisposing cause is dietetic, leading to a fat, plethoric condition in the animal, which is followed by a semi-comatose state, paralysis, and death.

Symptoms: The trouble occurs at any time during the month preceding lambing. Usually the first thing noticed is one or more ewes lying in a dazed condition, unable to rise, apparently paralysed. Death soon follows. An inspection of the flock will probably reveal further cases in an earlier stage, in which the animals are reluctant to move, take little or no notice of man or dog, and, if bustled, usually fall over.

On opening the carcase an overfat condition of the internal organs is seen—large deposits of fat around the kidneys; the liver is enlarged, of a pale colour, very fatty and friable, and its substance can readily be broken down by the fingers. In practically all cases it will be observed that the ewe was carrying twin lambs.

Treatment: Medicinal treatment of badly affected ewes is useless, as when once symptoms are advanced the disease is invariably fatal. On the other hand, preventive treatment is entirely satisfactory. Remembering that the cause operating is common to the whole flock, it may be expected that when a few deaths from this disease occur more will follow unless preventive methods be at once put in action. An immediate change of pasture for the whole flock is indicated—to barer feed if possible. Enforced exercise by rounding up of the flock and keeping the ewes on the move for an hour daily, driving them slowly, and not allowing them to be bustled by dogs practically always has the effect of stopping the mortality. After lambing, the danger from this disease is over.

EXTRUSION OF THE VAGINA.

Extrusion of the vagina in ewes before lambing (commonly termed "putting out the bearing") is a condition which in some seasons gives rise to considerable anxiety and loss.

The trouble is usually ascribed to the same cause as gives rise to antepartum paralysis—a too fat condition of the ewe. This is not always apparent, and one frequently hears it said that affected ewes were not to be described as overfat. The predisposing influence, however, appears to be primarily a seasonal one, consensus of opinion being that in seasons when feed is plentiful the ewes do not take sufficient exercise, resulting in sluggishness, fatty infiltration of the liver, and infrequent urination, causing distension of the bladder, ending in extrusion of the vagina. The incidence of the trouble is low in seasons when, owing to an unfavourable winter, feed is scarce, and the ewes being forced to travel for their feed are beneficially influenced by the exercise entailed.

The older the ewe the more likely is the trouble to occur. Ewes carrying their first lambs are not often affected. Its occurrence later is probably explained by the fact that in ewes which have already given birth to lambs the attachment of the vaginal walls has become more relaxed, and consequently the membrane is readily everted on straining. Spasm of the neck of the bladder, resulting from continence of urine, has also been referred to as a probable cause. Eversion of the vagina, as a rule, occurs in ewes carrying twin lambs.

Symptoms: The ewe shows uneasiness and straining. The "bearing" is seen protruding, and if long everted before being observed the parts are swollen and congested. The condition generally occurs within the week preceding lambing.

Treatment: If seen early, the "bearing" can be successfully returned. A sedative dose of two teaspoonfuls of laudanum in a little gruel is administered to the ewe. The hands and arms of the operator are washed in an antiseptic and oiled. The ewe is then placed on her side, the extruded membrane is washed with warm water which has been previously boiled (the use of strong antiseptic irritates the membrane and only induces further straining), and is

then carefully returned by the hand into the passage, and held there until warm. A few stitches are then usually inserted across the lips of the part, and the ewe is kept from movement for a time. In some districts a truss is used for this purpose, and is said to give good results. If straining be renewed, the dose of laudanum can be repeated after a few hours. A dose of 2 oz. of castor-oil given later will prove beneficial.

If the everted parts are much congested and inflamed before the animal is seen their return is, of course, rendered much more difficult. To be successful treatment must be adopted early, and then, as a rule, it is followed by safe lambing.

Prevention: Best results are obtained by frequently changing the ewes, thus enforcing plenty of exercise. A change on to young grass, by its laxative effect, greatly lessens the susceptibility to this most troublesome condition.

PROLAPSE OR EVERSION OF THE WOMB.

This accident follows lambing, but is not a commonly seen condition. It may be due to unusual spasm attending delivery, but it more often follows manual extraction of the fœtus in cases in which to rectify some wrong position assistance had to be given.

To return the womb the ewe is placed on her back. Two persons elevate the hind quarters by raising the hind limbs. The womb is then carefully cleaned and washed, any parts of the cleansing still attached removed, and the organ returned, commencing at the part nearest to the animal. As reduction proceeds, the fist is placed in the centre of the everted uterus, and as the latter slips back to the pelvic cavity it is followed up by the arm, which is kept in that position for a time. A few strong stitches are then inserted across the lips of the vulva, and the ewe may receive a dose of laudanum. The animal is kept as quiet as possible for a time, and should later be given a dose of castor-oil.

METRITIS OR INFLAMMATION OF THE WOMB.

Localized cases of inflammation of the womb, generally following a difficult lambing, are sometimes met with. The trouble is indicated by high temperature, quick breathing, and frequent straining, with a varying amount of discharge from the womb. Such cases should be isolated, the womb washed out with a solution of peroxide of hydrogen (one part to six of warm water), and the ewe treated to an opening dose of medicine, such as 4 oz. of Epsom salts with two teaspoonfuls of ginger dissolved in a pint of water.

GANGRENOUS MAMMITIS.

Fortunately not often met with, this is one of the most fatal diseases of the ewe. One-half of the udder becomes swollen, hard, and painful, and a blood-stained secretion may be drawn from it. The affected half of the gland rapidly becomes almost black in colour, gangrene sets in, and the skin of the udder sloughs away, as also does the skin along the belly. Death follows in a few days from blood-poisoning.

Treatment of individual cases should not be attempted. Being due to a germ and highly contagious, prevention of spread is the main object. This is best secured by slaughter of affected ewes and burning of the carcases. The entire flock should be removed to clean pastures, and contaminated paddocks either ploughed or kept free from sheep.

STOMATITIS (SORE MOUTH) IN LAMBS.

Lambs are occasionally affected with a form of sore mouth in which the lips swell and eruptions appear on the gums, palate, and tongue. The infection is spread to the teats and udders of the ewes by the lambs in suckling. The complaint does not cause serious systemic disturbance beyond a certain amount of loss of condition in the lambs through difficulty in feeding.

In treatment we have had quick results from the application to the lambs' mouths of an ointment made by mixing one part of sulphur with eight parts of vaseline. Smearing the ointment on the lamb's mouth plentifully, it will in turn be applied to the lesions of the ewe's udder by the lamb in suckling.

DIARRHŒA IN LAMBS.

This trouble sometimes occurs a few days after birth. It may be due to improper feeding of the ewes or to a contaminated condition of the pasture where lambing has taken place.

Treatment would indicate a change of feed for the ewes. It may be necessary in bad cases to separate the lambs from their mothers, feeding them with boiled milk. A teaspoonful of castor-oil to the lamb is useful. The shepherd's remedy of preparing rice-water in which a few raw eggs have been beaten up, and giving a wineglassful to each lamb affected with scouring, is often all that is required.

RUST IN PASTURE AND LAMBING.

It has been stated by sheep-farmers that prevalence of rust in grass is a cause of poor percentage of lambs, and at last year's annual conference of the Royal Agricultural Society the Department of Agriculture was requested to investigate the subject. An investigation was accordingly carried out by the various District Superintendents, who are qualified veterinarians, but they were unable to secure any data in confirmation of the statement in question. As pastures in the Hawke's Bay District were badly affected with rust that year, an Inspector of Stock specially visited a number of farms in the district to note the incidence of rust during the period when the rams were out with the ewes. In the ensuing lambing season the inquiry was followed up by this officer in connection with the same farms. He was unable, however, to glean any information that would justify him in stating that rust had affected the percentages of lambs. Even where the ewes were running on badly rusted pastures the percentages were well up to average.

Plant-bug attacking Turnips.—In January last a Marlborough correspondent forwarded specimens of an insect which was attacking turnip-plants just coming into rough leaf. The insect was identified by the Department's Entomologist as *Nysius huttoni*, a native species of plant-bug which punctures the tissues of a great variety of plants and sucks the sap, but which so far could not be regarded as a major pest. It is commonly found on turnip crops throughout New Zealand each year, even where no sign of injury is evident.

PARASITES OF THE PEAR-MIDGE (*Perrisia pyri*).

FIRST ATTEMPT AT THEIR ESTABLISHMENT IN NEW ZEALAND.

DAVID MILLER, Entomologist, Biological Laboratory, Wellington.

IN former articles published in this *Journal* on the pear-leaf-rolling midge (*Perrisia pyri*) the habits, distribution, and life and seasonal histories of the insect, as well as control experiments, have been dealt with by the present writer, and by Dr. R. H. Makgill, of Henderson. The present record sets out the results to date of the first attempt to introduce from Europe and establish in the Dominion insect parasites of the midge.

A difficulty at the outset was that, though a major pest in New Zealand, the midge is considered of but little account in Europe, where it has not attracted much attention. Therefore but little was known concerning the midge itself before its investigation in New Zealand was commenced during 1920, and almost nothing regarding its parasites until the matter was taken up in France last year. Prior to this the only information available concerning possible parasites was that a parasitic hymenopterous insect named *Inostemma piricola*, well known as a parasite of a species of pear-midge (*Contarinia pyrivora*) allied to *Perrisia pyri*, but attacking the pear fruit and not the leaves, had been reported by R. G. Mercet as having been reared also from *P. pyri*. In view of the recent investigations in France, however, there seems to be a possibility that this *Inostemma* is not *I. piricola* but a species as yet unnamed.

SEARCH FOR PARASITES IN FRANCE.

In 1925, since *Inostemma piricola* was the only known possibility at the time, and since it was a well-known parasite of the pear-fruit midge (*Contarinia pyrivora*), it was decided that an attempt should be made to secure this parasite from Europe for establishment in New Zealand. Through the Imperial Bureau of Entomology, London, the services of Dr. R. C. Fisher, of the Ministry of Agriculture, were secured. Dr. Fisher, though engaged on other work in France at the time, was good enough to undertake free of charge the collection of a consignment of pear fruit infested by *C. pyrivora* parasitized by *I. piricola* for transmission to New Zealand. While engaged in the pear-orchards at Bordeaux Dr. Fisher located an infestation of the leaf-rolling midge (*Perrisia pyri*), and found that this insect was being parasitized by another hymenopterous insect, an unknown species of the genus *Platygaster*. As will be noted later this was of considerable importance.

Dr. Fisher secured a considerable quantity of midge-infested pears in the hope that the parasite *Inostemma piricola* would be also present, and despatched the material under cool storage to New Zealand, where it arrived on 25th August of last year. This material, however, was found to be in a very dry condition, and the pears hard and woody.

In some of the specimens cut open for examination dried remains of midge-larvæ were found. Though not much hope was entertained of parasites being reared from this consignment, the material was kept moist and in cool storage in the laboratory until the leaf-rolling midge (*P. pyri*) was due to emerge in the spring from hibernation in New Zealand. This will in future be referred to as the "first consignment."

Owing to Dr. Fisher's duties with the Ministry of Agriculture preventing him carrying on the work of securing midge parasites at that time, Mr. J. G. Myers, of this Department, who was then in North America, was commissioned to proceed to Europe and make as extensive a search for suitable parasites as time would allow. For about seven weeks during July and August (1925) he studied the problem in Europe, mainly in the vicinity of Paris, where he had the double advantage of having at hand pear-orchards infested with the leaf-rolling midge, and of Dr. Paul Marchal's assistance and "valuable advice in an investigation closely related to his own classical researches."

Mr. Myers succeeded in locating three types of parasites of the leaf-rolling midge, all of which are as yet unidentified hymenoptera—namely, (1) a species of *Inostemma* closely resembling the *I. piricola* already referred to, (2) the species of *Platygaster* discovered by Dr. Fisher, and (3) a number of metallic-green chalcidoids of different sizes, which may or may not belong to the one species. He found that both the *Inostemma* and *Platygaster* parasitize the eggs of the midge, and that their larvæ are internal parasites of the midge-larvæ, while the larvæ of the chalcidoids are external parasites of the latter. He also reported that the *Platygaster* parasitized as much as 58 per cent. of the midge-larvæ. It may be that the *Inostemma* bred from *Perrisia pyri* by Mercet, and identified by him as *I. piricola*, is really the same species as the unidentified *Inostemma* found by Mr. Myers, and not *I. piricola*.

Mr. Myers secured a quantity of pear-leaves infested by the leaf-rolling midge and its parasites, packed the material in moist sphagnum moss, and sent it to New Zealand in cool storage. It arrived at Auckland in good condition on 8th October last, and on receipt was again placed in cool store. This will in future be referred to as the "second consignment."

On Mr. Myers returning to America, Dr. Fisher, who was then free, undertook to carry on the work in France. This was done in October, but owing to the lateness of the season but little midge material could be found. Nevertheless a small consignment was secured from localities where the three above-mentioned parasites were still at work, and sent packed in moist sphagnum moss to New Zealand. This was received here early in December. Before shipping, Dr. Fisher examined some of the midge-larvæ and found the *Platygaster* appearing "as a very young embryo or extremely early larval stage. It appeared as a kind of cyst, circular in shape, and apparently could occur in different portions in the body of the host." This second shipment from Dr. Fisher will in future be referred to as the "third consignment."

DESCRIPTIONS OF THE PARASITES.

In order to give some idea of what the three species of parasites mentioned look like it may be noted that they all belong to the order of insects known as the *Hymenoptera*, which also includes such familiar forms as wasps, bees, and ants. A considerable proportion of the members of this order are parasitic upon other insects, and they range in size from extremely minute to comparatively large species All are possessed of two pairs of membraneous wings supported by several, few, or even no "veins," according to the species. The three parasites in question are small insects, and their wing-venation is not well developed.

The female members of the genus *Inostemma* are very easily recognized by the peculiar horn-like process that projects from the upper surface of the abdomen, where it forms a "waist" at its junction with the thorax. This process curves forward over the back of the insect toward the head. Each forewing is supported by a single short "nerve," ending in a slightly swollen end (Fig. 1).

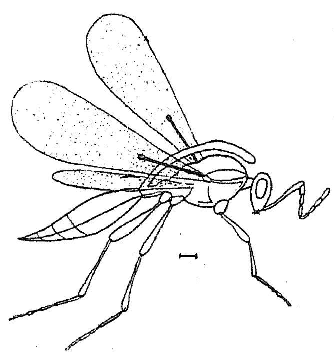

FIG. 1. FEMALE OF GENUS INOSTEMMA SHOWING CHARACTERISTIC ABDOMINAL PROCESS.

Small line beneath insect denotes natural size.

[*After Ashmead.*

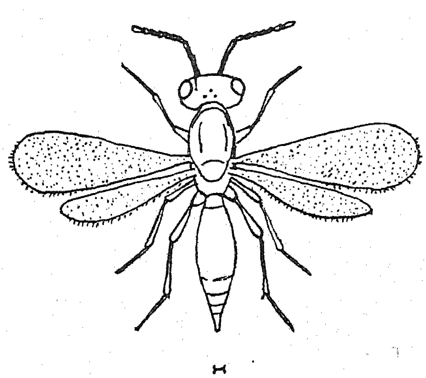

FIG. 2. FEMALE PLATYGASTER.

Small line denotes natural size.

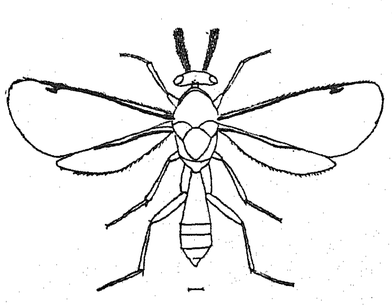

FIG. 3. CHALCIDOID.

Small line denotes natural size.

The *Platygaster* mentioned is a small black insect with a rather pointed abdomen. Its wings are unsupported by any "nerves" (Fig. 2).

The chalcidoids found attacking the pear-midge are somewhat larger and of a brilliant metallic-green colour. Each forewing is supported by a single "nerve" that extends to the fore border; from near its extremity the "nerve" gives off a short branch (Fig. 3).

Establishment in New Zealand.

The work of establishing the parasites necessitated constant daily attention, and Mr. J. Muggeridge, of this Laboratory, co-operated with the writer in observing and handling them.

METHODS EMPLOYED.

For the purpose of establishing the parasites and for their safe handling, to ensure that nothing other than the species required should be liberated — as it was expected that from the consignments sent insects other than parasites, which might escape and become injurious, would develop as well—a specially constructed outdoor insectary was erected over a small midge-infested pear-tree in Mr. W. G. Williams's orchard at Henderson, Auckland. This insectary (Figs. 4 and 5) consists of a wooden framework covered on the north, east, and west sides with 100-mesh wire gauze. The south side is boarded over with tongued-and-grooved timber, lined on the inside with a sheet of asbestos, and, as a protection from weather, with Ruberoid on the outside. In this end is a narrow wooden door lined with asbestos on the inside, and protected on the outside by a porch and outer door, both covered externally with Ruberoid. The inside of the porch is painted black, and into it both doors open. The roof has a low pitch, and is a wooden frame supporting panes of translucent glass. Wooden eaves project from the margins of the roof. The gauze on the three sides does not reach the ground, the sides being boarded all round to a height of about 1 ft.; this boarded portion is also continued into the ground and lined on the inside with asbestos. The exposed wood of the framework is painted white. When necessary the number of midges in the insectary was augmented by securing supplies by means of emergence-tents pitched in the orchard.

A number of emergence-boxes were made similar to those designed and used for parasite work in the United States. Each consists of a strong, oblong, shallow box, along one side of which holes are bored for the reception of the glass tubes and the securing of insects emerging as they come to the light. Each box is closed by a wooden lid, and also, beneath this, by a close-fitting glass lid on a wooden frame (Fig. 6). A very useful type of emergence-box for small quantities of material was made from wooden boxes used for the storage of half-plate photographic negatives (Fig. 7). Two holes were bored in one side for insertion of emergence-tubes. The mouth of the box was closed, after the parasitized material had been inserted, by a square of glass corresponding to the glass lid of the larger boxes, supported on a narrow wooden shelf nailed inside to each end of the box just

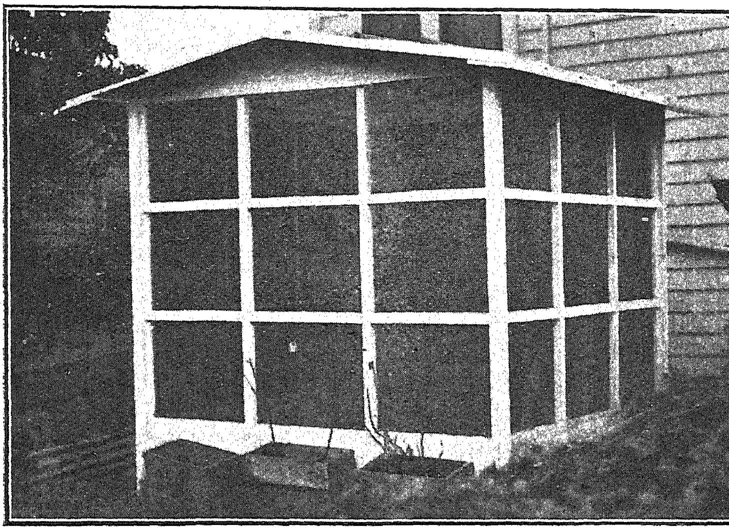

FIG. 4. TYPE OF INSECTARY ERECTED OVER CAGE AT HENDERSON.

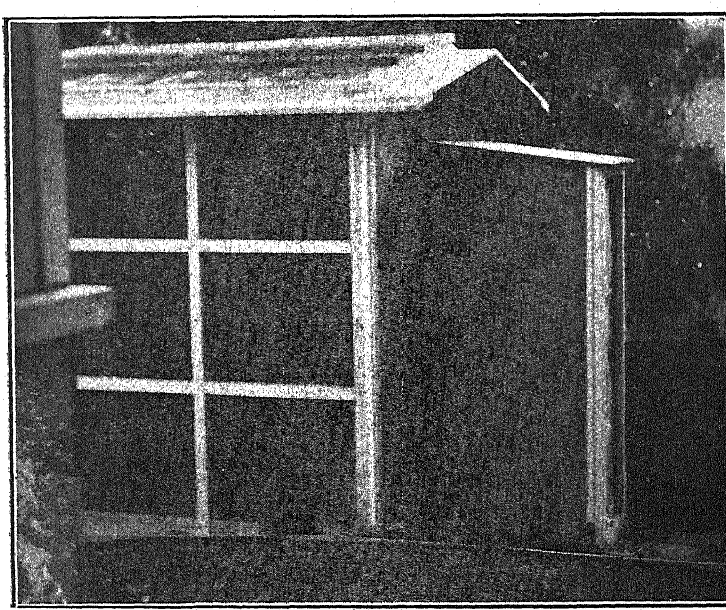

FIG. 5. PART OF SAME INSECTARY SHOWING PORCH.

[*Photos by H. Drake.*

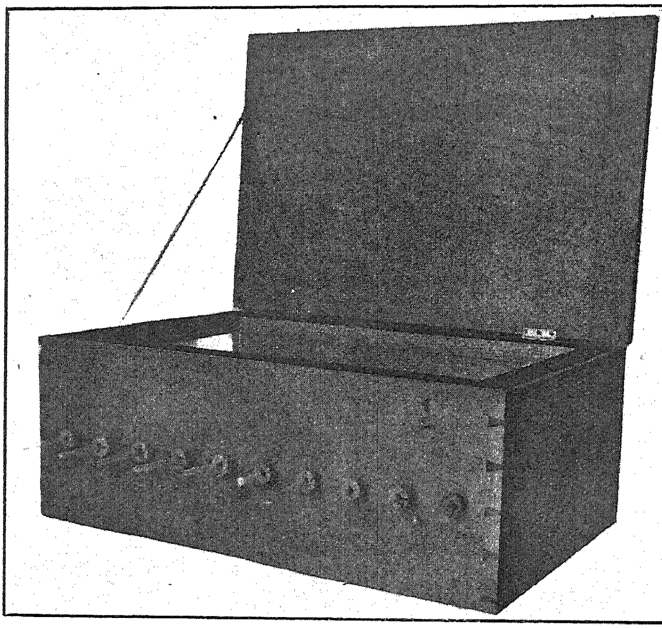

FIG. 6. LARGE EMERGENCE-BOX.
Note spraying-nozzle in centre plugged with cotton-wool.

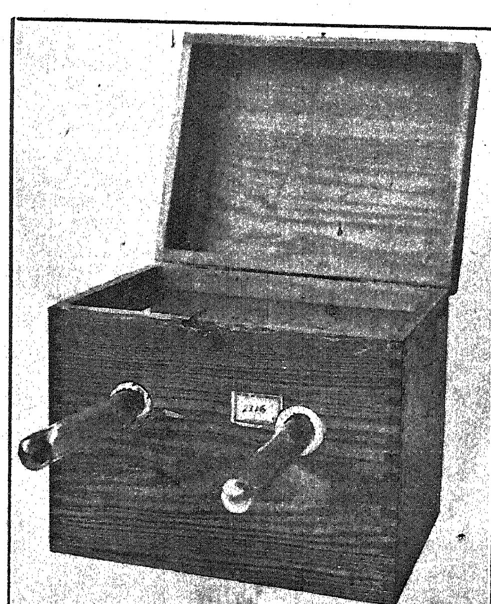

FIG. 7. SMALL EMERGENCE-BOX ADAPTED FROM A HALF-PLATE PHOTO-NEGATIVE STORAGE BOX.

[*Photos by H. Drake.*

below the edge of the mouth. The glass was held in position and the box rendered insect-proof by means of odourless plasticine used to seal the glass in position.

Material from which parasites and other insects were emerging in the emergence-boxes was kept suitably moist by means of a fine spray of water. In order to do this without risking the escape of even minute insects the following method was devised: One of the glass emergence-tubes near the centre of each box was replaced by a piece of 4 mm. glass tubing about 4 in. long, having the end inside the box drawn out in the form of a slightly bent nozzle with a small aperture. Though there was but little chance of even minute insects first finding and then getting through the aperture of this nozzle, the outer end of the tubing, when not being used, was kept plugged by a piece of cotton-wool (Fig. 6). When applying water to the material in the boxes the exit-tube of a wash-bottle was connected by a length of rubber tubing with the outer end of the glass nozzle. The water was then blown into the latter, and when the wash-bottle was held above the level of the emergence-box a stream of water siphoned through into the box and was delivered as a spray through the narrow aperture of the nozzle. The nozzle being slightly bent, the water could be distributed over a broad crecentic area from end to end of the emergence-box by slowly turning the cork carrying the nozzle.

In order to study the habits of the parasites on their emergence from the imported material, glass lamp-chimneys having the ends closed with fine muslin, and each chimney enclosing a pear-shoot having opening leaves upon it, were used. The type of chimney giving the best results is that shown in Fig. 8. It will be noticed that there is a series of holes through the glass toward the bottom. Each hole was kept plugged with cotton-wool wrapped in cigarette-paper, and when an insect was to be inserted one of the plugs was removed and the mouth of the emergence-tube containing the insect applied to the opening. By this means the chances of an insect escaping were reduced to a minimum. Without these holes one of the muslin caps closing the ends of the chimney would necessarily have to be removed and again replaced, giving ample opportunity for the escape of any insect.

These chimneys were used in two ways: Some were suspended from the roof of the insectary, and enclosed shoots of young trees kept growing in boxes; others, with the upper end only closed with a muslin cap, were stood upon and sealed with odourless plasticine to squares of strawboard, each square holding a chimney having a central perforation. Through the latter and sealed there with plasticine a shoot cut from a pear-tree projected into the chimney, and its other end was immersed in a bottle containing water. Shoots enclosed thus kept fresh, and even developed leaves, for over six weeks.

For some time prior to the appearance of the first parasites a constant supply of pear-midges was kept emerging from emergence-boxes and allowed to infest pear-leaves enclosed in glass chimneys. In this way supplies of midge eggs and larvæ were available for any parasites when they should appear, when it would be possible to segregate the different types and test each separately.

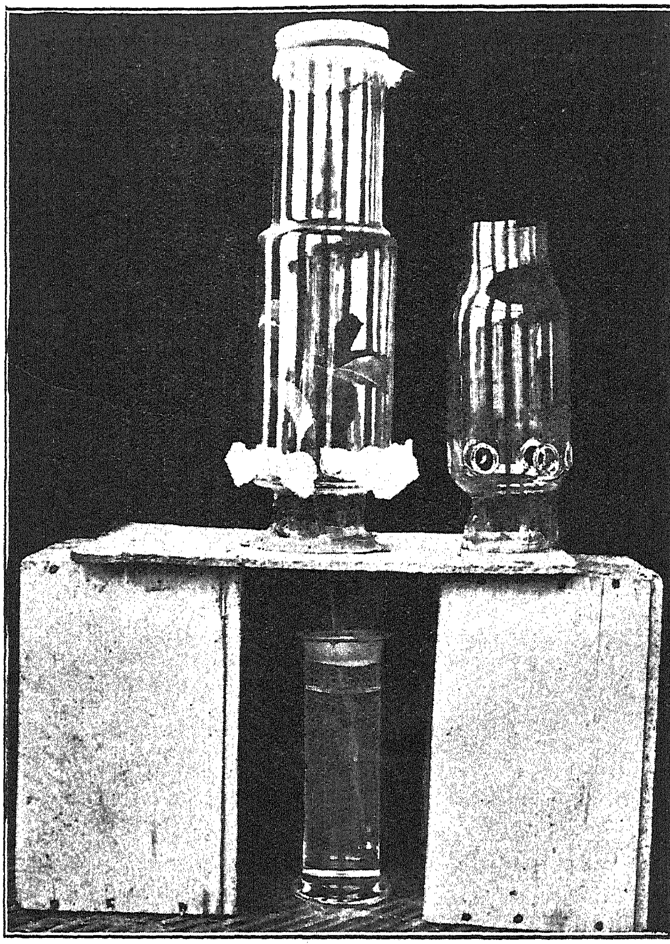

FIG. 8. LAMP-CHIMNEYS USED TO ENCLOSE PEAR-SHOOTS FOR OBSERVING PARASITES.

On right is a small chimney showing side holes unplugged.

[*Photo by H. Drake.*

EMERGENCE OF PARASITES.

First Consignment.

This material was removed from cool storage on 1st September and placed in emergence-boxes "A." But though kept moist and under observation well on into January no parasites or even midges (in this case the fruit-midge, *Contarinia pyrivora*) emerged. All the pears were then opened up and examined, and the dried remains of insect larvæ were found in a few.

Second Consignment.

This consignment arrived in New Zealand on 8th October, and was immediately placed in cool storage. On the 9th a portion of this

material was removed from cool storage and placed in emergence-box "B." During the following three months the only insects developing from this were a predaceous-beetle larva and six midges, none of which was the pear-midge (*Perrisia pyri*), but a species apparently breeding in the sphagnum moss used for packing.

On 28th October another portion of the second consignment was taken from cool storage and placed in emergence-box "C." From this up to the end of January the only insects developing were eight midges, six of which were similar to those emerging from box "B," and two pear-midges (*Perrisia pyri*).

On 18th November a third portion of the second consignment was taken from cool storage and placed in emergence-box "D." On this date a predaceous-beetle larva, similar to the one appearing in emergence-box "B," was captured from box "D."

The following records made between 29th November and 16th December inclusive refer to insects emerging from box "D":—

November 29th: One midge (not *Perrisia*) emerged.

November 30th: Three midges (not *Perrisia*) emerged.

December 7th: Between November 30th and this date there were no emergences, when the first parasite, a female *Platygaster*, was secured and preserved for examination. A number of midges, including a considerable percentage of *Perrisia*, also appeared.

December 8th: A number of midges, including *Perrisia*, and a species of parasite belonging to the hymenopterous group *Ichneumonoidea* emerged. This ichneumonoid was destroyed, as it was not one of the types of parasites being searched for.

December 9th: Two female and one male *Platygaster* emerged, also an abundance of *Perrisia*.

December 10th: One female and one male *Platygaster* and several midges (including *Perrisia*) emerged. The three *Platygaster* that emerged on the previous day were now liberated upon a pear-shoot (covered by a glass chimney) upon the young leaves of which midges were and had been ovipositing. This was numbered "Lot 1." The two parasites secured on this date were similarly placed on "Lot 2." The parasites, on liberation, immediately commenced searching for midge-eggs, feeling the leaves with their antennæ, or forcing these appendages between the folds of the leaves. When a batch of eggs was located the parasites oviposited in them, working rapidly. Many of the midge-eggs were laid among the epidermal hairs of the leaves and leaf-petioles, so that the movements of the parasites were readily followed.

December 11th: No parasites, but numerous *Perrisia* and other midges, emerged. In the report made by Mr. Myers on his work in France mention is made of an insect—a capsid bug—that he observed attacking the pear-midge larvæ. This bug is of quite a different type to the hymenopterous parasites already referred to, and belongs to the same order of insects as cicadas and aphids. On this date a bug appeared for a brief space in one of the emergence-tubes. However, before it could be secured it had retreated and was not observed to appear again either in the tubes or from among the moss in the box;

neither were its remains found when searched for in the sphagnum moss in March some time after any insects had ceased to emerge. It is possible that this bug was the species of capsid seen in France.

December 12th: No further parasite, but abundant midge (including *Perrisia*), emergence. The parasites placed on pear-shoots on the 10th (Lots 1 and 2) died on this date.

December 13th: No parasites and only a few *Perrisia* emerged.

December 14th: One female and one male *Platygaster*, a single specimen of the metallic-green chalcidoids (one of the three types being looked for), and several *Perrisia* midges emerged. This was the only occasion on which a chalcidoid appeared, and the specimen was preserved. The two *Platygaster* were liberated on pear-leaves upon which midges were ovipositing, and were numbered "Lot 3."

December 15th: No parasites, but *Perrisia* midges, emerged.

December 16th: No parasites, but a few *Perrisia*, emerged. On this date the remainder (half of total) of the second consignment was taken from cool storage and placed in emergence-box "E." The object in retaining most of the consignment until this date was that the greatest number of parasites would be secured at the period when the pear-midge had reached its maximum development for the season. As twenty-six days had elapsed from 18th November, when the third portion of the second consignment was placed in box "D," until 8th December, when the first *Platygaster* emerged, it was considered that, from material brought from cool storage about the current date, parasites should become available in less than twenty-six days, owing to the greater warmth of the season.

December 17th to 28th: During this period some *Perrisia* and a few other midges (but no parasites) emerged intermittently from box "D," but nothing from box "E."

December 29th: One female and one male *Platygaster* and a few *Perrisia* emerged from box "D." These parasites, the last to emerge from this emergence-box, were liberated on pear-leaves infested with midge-eggs, and numbered "Lot 4." No insects appeared in box "E."

The following records refer to observations concerning box "E," from which nothing so far had developed:—

December 31st: One female and one male *Platygaster* and a number of *Perrisia* emerged. In this instance fifteen days had elapsed before any parasites emerged after the material had been taken from cool storage: this was probably due to increase in temperature. The two parasites were liberated on the midge-infested tree covered by the insectary at Henderson.

January 1st (1926): Two female and one male *Platygaster* and several *Perrisia* emerged. The parasites were liberated on the tree in insectary.

January 2nd to 4th: During this period four female and two male *Platygaster*, together with several *Perrisia*, emerged, and the former were liberated on the tree in insectary.

January 5th: No parasites, but only a few midges, emerged.

January 6th: Two female and three male *Platygaster* were secured and liberated on tree in insectary. Several *Perrisia* also emerged.

January 7th and 8th: Several midges, but no parasites, emerged on these two days.

January 9th: Eight female and three male *Platygaster* were secured. There was also a slight increase in the number of *Perrisia* emerging. These eleven parasites, which were seen mating, were liberated in the midge-infested orchard in which the insectary stands at Henderson.

January 10th: No parasites, but only a few midges, emerged.

January 11th: Two female and one male *Platygaster* emerged, together with a few midges. The parasites were liberated in the orchard.

January 12th: Two female and two male *Platygaster* and an increased number of midges emerged. The parasites were liberated on the tree in insectary.

January 13th: One female and one male *Platygaster* and a few midges emerged.

January 14th: Three female and two male *Platygaster* and numerous midges appeared. These five parasites, together with the two that emerged on the previous day, were liberated on tree in insectary.

January 15th: Four female and one male *Platygaster* and numerous midges emerged.

January 16th: One female and one male *Platygaster* and a few midges were secured. These two parasites and the five of the previous day were liberated in the orchard.

January 17th to 21st: Four female and one male *Platygaster* emerged, and numerous midges. On the 18th, during this period, there was no parasite emergence. These five parasites were liberated on tree in insectary.

January 22nd to 26th: No emergence of parasites, and very few midges.

January 27th: One female *Platygaster* was secured and liberated on the tree in insectary. After this date there was no further emergence of parasites from the second consignment, though a few midges appeared at intervals during the following fortnight.

Third Consignment.

On arrival in New Zealand early in December this consignment was placed in two emergence-boxes—" F " and " G." From " F " only midges (no *Perrisia*), a species of chrysomelid beetle, and two species of tortricid moths developed. From box " G," besides the species of tortricid and beetle similar to those secured from box " F," the following parasites emerged:—

January 7th: One female and one male *Platygaster*; liberated on tree in insectary. Some *Perrisia* and other midges also emerged.

January 15th: Two female *Platygaster* and a few midges.

January 18th: One female and two male *Platygaster*, as well as a few midges, appeared. The parasites, together with the two secured on the 15th, were liberated on tree in insectary.

January 25th: One female *Platygaster* and two midges. The former was liberated on tree in insectary.

SUMMARY OF PLATYGASTER EMERGENCES.

Date of Emergence.	Number.		History.
	Females.	Males.	
			(1.) From Second Consignment.
1925.			
December 7 ..	1	..	Killed for examination.
,, 9 ..	2	1	Put on *Perrisia* egg-infested leaves: Lot No. 1.
,, 10 ..	1	1	,, Lot No. 2.
,, 14 ..	1	1	,, Lot No. 3.
,, 29 ..	1	1	,, Lot No. 4.
,, 31 ..	1	1	Liberated on tree in insectary, Henderson.
1926.			
January 1 ..	2	1	Liberated on tree in insectary, Henderson.
,, 2–4	4	2	,, ,,
,, 6 ..	2	3	,, ,,
,, 9 ..	8	3	Liberated in orchard, Henderson.
,, 11 ..	2	1	,, ,,
,, 12 ..	2	2	Liberated on tree in insectary, Henderson.
,, 13 ..	1	1	,, ,,
,, 14 ..	3	2	,, ,,
,, 15 ..	4	1	Liberated in orchard, Henderson.
,, 16 ..	1	1	,, ,,
,, 17–21	4	1	Liberated on tree in insectary, Henderson.
,, 27 ..	1	..	,, ,,
Totals ..	41	23	
1926.			*(2.) From Third Consignment.*
January 7 ..	1	1	Liberated on tree in insectary, Henderson.
,, 15 ..	2	..	,, ,,
,, 18 ..	1	2	,, ,,
,, 25 ..	1	..	,, ,,
Totals ..	5	3	
Grand totals	46	26	

Of the complete totals of 46 females and 26 males, therefore, 1 female was killed for examination, 5 females and 4 males were placed with *Perrisia* egg-infested leaves (Lots 1–4) in the insectary, 15 females and 6 males were liberated in the orchard at Henderson, and 25 females and 16 males were liberated on tree in insectary at Henderson.

COMMENT ON PARASITE EMERGENCE.

The result of the emergence of parasites, based upon the number of species secured, shows that the material sent was most heavily parasitized by *Platygaster* sp., but little by the chalcidoids, and not at all by *Inostemma*—the three types of parasites for which we were on the lookout. It is possible, however, that, though only one chalcidoid and no *Inostemma* appeared, the conditions during transit favourable for *Platygaster* were unfavourable for the well-being of the chalcidoids and *Inostemma*.

Sunlight had a marked effect upon the *Platygaster*. On dull days there was no activity, but on sunny days the parasites became extremely active. Even though the *Platygaster* had emerged in the

emergence-boxes, very few, if any, would enter the glass collecting-tubes unless the latter were exposed directly to the sun. This influence of the sun was also noted in France.

The emergence of *Perrisia* and *Platygaster* in the emergence-boxes synchronized, the former insect usually being most numerous when the latter was emerging. It is to be noted also that a few *Perrisia* emerged before the first *Platygaster*, and, though the numbers fell off when no *Platygaster* were emerging, the midges did not cease altogether; and for some days after the last parasites emerged a few *Perrisia* appeared. The proportion of female *Platygaster* was considerably in excess of that of the males. The figures relating to the second consignment show that from the first emergence on 7th December until 4th January the numbers emerging were remarkably constant. From 6th January the daily emergences increased, reaching a maximum on the 9th, thereafter falling off considerably but keeping more or less constant until the 15th, after which date, until the 27th, when the last parasite emerged, the daily average was comparatively low. As the humidity in the emergence-boxes was kept as near constant as possible the above-mentioned fluctuation was no doubt influenced to a very great extent by increase of temperature.

The third consignment gave very poor results. This was no doubt due, as Dr. Fisher points out, to the difficulty of securing any quantities of *Perrisia* material, owing to the lateness in the season (October) when he undertook the work of collecting.

HISTORY OF PERRISIA EGGS PARASITIZED IN LOTS 1 TO 4.

The leaves of Lots 1, 3, and 4 were kept under close observation, and the midge-larvæ on leaving the leaves were given fine and moderately moist earth in which to pupate. It was found, however, that some preferred to spin the pupal cocoon (Fig. 9) among the dead pear-leaves, rather than burrow into the earth. The earth and leaves were secured

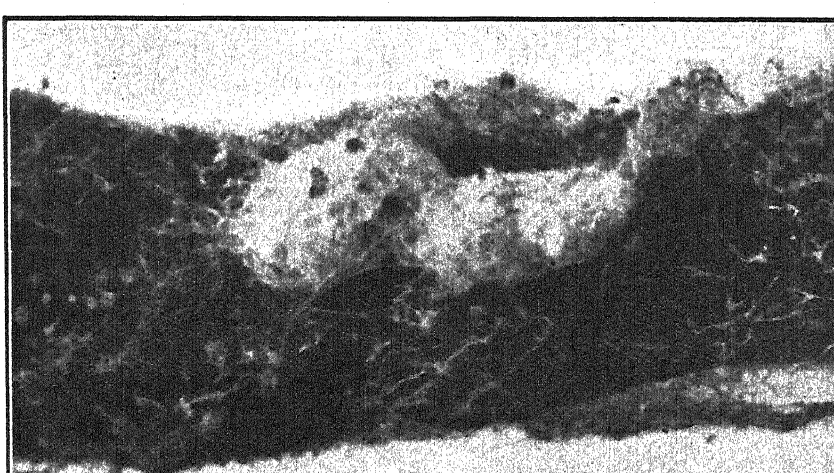

FIG. 9. COCOONS SPUN BY PEAR-MIDGE LARVÆ PRIOR TO PUPATION ON A DEAD LEAF. HIGHLY MAGNIFIED.

[Photo by H. Drake

in small emergence-boxes, but no parasites or even midges have emerged therefrom. A few midge-pupæ that remained among the dead leaves were examined microscopically, but no sign of parasites could be seen.

Ten midge-eggs found in the leaves of Lot 2 were carefully examined for parasite eggs, and in two cases what appeared to be such eggs were seen. Of five larvæ examined from this lot six days after hatching, a parasite larva was found in one of them.

Owing to the limited number of *Platygaster* secured it was considered inadvisable to sacrifice more material for detailed examination, the main object in view being first the establishment of a parasite.

HISTORY OF PLATYGASTER LIBERATED ON TREE IN INSECTARY AT HENDERSON.

On the liberation of the *Platygaster* on the tree in the insectary at Henderson the females sought out the leaves infested with *Perrisia* eggs, and on finding batches of eggs commenced to oviposit in the same way as they had been observed to do in Lots 1 to 4. Mr. Muggeridge also observed the *Platygaster* actually piercing the *Perrisia* eggs during oviposition. Several lots of leaves containing midge-eggs, upon which, during oviposition, the *Platygaster* had been followed by Mr. Muggeridge, were removed from the tree just prior to the midge-larvæ pupating and placed in emergence-boxes. Though midges emerged in all cases, from only one (designated emergence-box " H ") did four parasites emerge. These parasites were all male *Platygaster*. The history of this material in box " H " was that midge-eggs were parasitized on 13th January, the first male *Platygaster* emerged on 16th February, and the other three four days later.* This seems to point to the fact that the cycle of the *Platygaster* apparently corresponds with that of *Perrisia*, which takes approximately one month to develop from egg to adult.

Observations made in the Henderson cage during February, March, and April have failed to show any signs of living *Platygaster*, though several dead females were found entangled in spiders' webs. These dead parasites, however, might well have been some that had been liberated earlier from the emergence-boxes.

During this winter the tree in the insectary will be pruned so as to give a maximum growth of leaves next spring, when there should be an appearance of parasites as well as midges.

HISTORY OF PLATYGASTER LIBERATED IN ORCHARD.

In the Henderson orchards the *Perrisia* infestation this season had reached its maximum by the end of December, after which it showed a decided falling-off. The *Platygaster* liberated in the orchard on 9th, 11th, 15th, and 16th January, however, still had a fair supply of *Perrisia* eggs at their disposal, and were seen ovipositing in egg-infested leaves. Though the next brood of midges was comparatively nil, it is hoped that the *Platygaster* will have parasitized sufficient *Perrisia* to put in an appearance with the midge next spring.

* The development of only one sex from a batch of eggs is known to occur in other *Hymenoptera*. For instance, Jones recently recorded that the unfertilized eggs of a certain species always produced males (*Jour. Econ. Ento.*, vol. xix, p. 312, 1926).

ACKNOWLEDGMENTS.

To the efforts in France of Dr. R. C. Fisher, of London, and Mr. J. G. Myers, of this Laboratory, the success of the arrival in New Zealand of shipments of living parasites is due, as well as to the assistance and advice given by Dr. Paul Marchal, Director, Entomological Station, Paris, who is a noted authority. Dr. G. A. K. Marshall, Director, Imperial Bureau of Entomology, London, also rendered very considerable assistance.

For the safe transit of the parasites aboard ship we are indebted to the Shaw, Savill, and Albion Company, the Federal Steam Navigation Company, and the Commonwealth and Dominion Line.

Mr. W. G. Williams, of Henderson, has kindly put his pear-orchard at our disposal for establishment work. Our thanks are also due to Mr. W. Rice, Orchard Instructor, Auckland.

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TOP-DRESSING DEMONSTRATION AT MORTON MAINS.

IN an endeavour to still further popularize the top-dressing of pastures in Southland an area of land was selected in July, 1925, and a small experimental area established on the farm of Mr. William Barron, at Morton Mains. The local branch of the Farmers' Union erected the necessary fencing, and did all other initial work required. The area was a pasture which had been down for eight or nine years and had never been top-dressed, although the land had been limed many years ago. When the area was taken over the dominant grass was browntop (*Agrostis tenuis*); cocksfoot, crested dogstail, alsike, and white clover were present, but in a very weak condition.

The manurial treatments per acre were as follows: (1.) 44/46 superphosphate, 3 cwt. (2.) 44/46 superphosphate, 3 cwt.; carbonate of lime, 1 ton. (3.) 44/46 superphosphate, 2 cwt.; Nauru rock phosphate, 1 cwt.; sulphate of ammonia, ½ cwt. In laying out the experiment the usual controls were provided, and each plot was made 5 chains long by ½ chain in width. All plots were repeated, which gave a length of 10 chains by ½ chain for each manurial treatment.

In the spring No. 3 treatment showed the earliest growth, but the other plots soon outdistanced it, and at time of weighing it did not compare favourably with the others either in weight or clover content. The weighings were taken from strips ½ chain long by 4 ft. 6 in. wide, and the herbage in all cases was weighed as soon as it was cut.

Following are the average green weights of ten weighings for each plot: Control, 25·5 lb.; superphosphate, 47·6 lb.; control, 21 lb.; super, Nauru rock phosphate, and sulphate of ammonia, 38·5 lb.; control, 25·6 lb.; super and carbonate of lime, 54·3 lb.; control, 24·1 lb.

On 9th February last the Farmers' Union held a field-day at the area to give all those interested an opportunity of viewing the results of the experiment. On the top-dressed plots, especially Nos. 1 and 2, the alsike, white clover, suckling-clover, cocksfoot, and crested dogstail had taken a new lease of life. The clovers especially were very vigorous, and their growth was in marked contrast to the condition of the clovers on the adjoining control plots.

WOOL-GROWING IN NEW ZEALAND.

SOME PRACTICAL POINTS FOR SHEEP-FARMERS.

Paper read by WILLIAM PERRY, "Penrose," Masterton, at the Annual Conference of the Royal Agricultural Society of New Zealand, Wellington, May, 1926.

THE sheep-stock of New Zealand have gone through many and various changes. In the early years of colonization wool-production was almost the only consideration, and the Merino and the Merino-cross sheep were the predominant breeds. But with the advent of the frozen-meat trade the longwool breeds began to find favour and took the place of the Merino, and now with the wonderful expansion of the fat-lamb trade a change has come over the whole sheep-raising industry The proportion of longwool breeds has greatly increased, and consequently brought about a corresponding increase in the stronger wools of the Dominion.

There are three breeds of sheep which are coming very much into prominence—namely, Romney Marsh, Corriedale, and Southdown.

The New Zealand Romney has become somewhat different from its English cousin. It is a smaller and more compact sheep, and its wool has more lustre. A large amount of our Romney wool can be styled a lustre wool, whereas the Romney Marsh of Kent is supposed to grow demi-lustre wool. The best type of New Zealand Romney wool has lustre, length of staple, and is soft to handle; the average count is about 46's. Sheep carrying wool of this nature throw off the rain very effectively, carry a full fleece under adverse conditions, and shear a remarkable weight of wool. Some wool experts seem to think that the Romney should be made to grow wool of a 50's count. This could be done, but it would not prove a commercial proposition, as Romneys with a very fine fleece have a tendency to cast the wool on the points and produce a very light clip. The main faults breeders of Romneys have to contend against are kemps, dual fibres (hair and wool), harsh wool (semi-hair), and hairy breech-wool.

The Corriedale breeders have done great work in producing a valuable breed of sheep, more especially suited to a dry climate. The average wool count is about 50's. The best specimens of the breed have a very-high-quality wool. Breeders of the Corriedale have some of the same faults to combat as the Romney breeders, but in a lesser degree.

The Southdown is bred for mutton almost exclusively, but the wool is valuable for some purposes. Although Southdown wool is more crisp, the best fleeces show the same characteristics as the best long-wools.

With the Romney, Corriedale, and Southdown it is desirable to have a solid, fairly square lock or staple, with the curl carried from the tip right to the skin. The lock itself should hold together, but the best wools are very free from cross-fibres between the locks. Wool of this nature will comb without much waste, or "noils" as they are called in the trade. Wool on the sheep (provided the animal is in fair condition) should open cleanly, and have a nice soft yolk carried right to the tip of the wool, with a soft pliant feel to the hand. Good

wool, whether it be of high or low count, should be bright in appearance (not a dead metallic white), with more lustre as the count goes lower. The yolk should be thin and about the colour of olive-oil. Heavy, yellow yolk generally goes with a poor class of wool. Sheep with thin or small staples or locks may have very good wool, but unless it is dense the back wool will not stand much rain, and will become weak and wasty. Sheep with thin locks will not stand a cold, damp climate.

Many breeders try to produce sheep with a very short curl in the wool, but this can be easily overdone. The length of the curl should be governed by the count or fineness of the fibre. For instance, a 46's Romney wool should have from five to seven curls to the inch, and a 36's about three to four to the inch. The best wools have a very gradual turn in the curl, and the curl should run longitudinally and not across the lock. Some brittle, harsh-handling wools have a short curl, but it is abrupt and runs across the lock, and on examination generally proves to be semi-hair.

The following extract from Bowman's book on wool-fibre may be here usefully quoted: "The wool-fibre has its growth from the skin of the animal, the root or starting-point being like a bulb. The blood-vessels of the body feed this bulb-like vessel with plastic lymph, which is changed by nature into nucleated cells. Nature further pushes this substance through the skin to the surface. This operation seems to change the outer or surface cells into flat scales, which form the outer wall of the fibre, the remainder of the cells forming the centre of the fibre. These cells form a loose mass, which allows the yolk or suint to flow through the centre of the fibre. The yolk seen on wool is quite separate from ordinary sweat. It is formed in a separate gland and fed into the wool-fibre before the latter comes through the skin. It then percolates through the centre of the fibre, a portion coming out through the open end of the scales on to the surface of the wool to nourish it."

The principal difference between a hair and a true wool-fibre is that the hair has a central core or medulla, which when seen through a microscope looks like a black strip. The scale formation is also different; the scales on hair are fastened very closely down, probably for two-thirds of their length, whereas the scale on wool is much more free. The woolgrowers' work is to eliminate all fibres showing a black centre, which are hairs, or those which show black disconnected streaks, termed semi-hairs.

There are several forms of hair to be found on sheep. Kemps are a short hair mostly found on the thigh and over the hips of a sheep, but sometimes all over the body. The hairs which cause the most trouble are those which are the same length as the wool-fibre, and sometimes appear longer. They are a metallic-white colour, always nearly straight, and will not take dye. Many sheep have hairy breech-wool —that is, wool and hair. This trouble can be bred out of any breed of sheep; it is just a matter of selection and care. The hair on the face, legs, or ears of a longwool sheep is a good guide to the nature of the animal. If it is hard to the feel, dirty-white in colour, and of a coarse appearance, then one can expect a second-rate fleece. On the other hand, if the poll shows no hair, and the hair on face, ears, and

legs shows good quality, with a bright, smooth appearance, one can expect the fleece to open up well. Mr. A. H. Cockayne (Department of Agriculture) has found by investigation that the harsh hairs are more or less flat, and the smooth, bright hairs are more of a rounded shape.

The nature and quality of the wool-fibre largely depend on the formation of the scales, and it seems possible by selection to breed great variations in scale formation. The scales govern the amount of yolk which comes from the centre of the fibre, the elasticity, and also to a certain extent the particular kind of curl. A short, open scale allows the yolk to flow out too freely, and therefore a sheep has to be in high condition before the yolk reaches the tip of the wool. Under ordinary conditions the tip will be dry and hairy. A short, open, pointed, scaled fibre is rough to the touch when rubbed between the finger and thumb, it does not stretch much, and will break off short when tested between the two hands.

Some wools have a pointed scale with a hook-like tip. These are very undesirable, and are the cause of most of the cotted or matted fleeces. This kind of wool, though it may be all right when shorn, will cling together afterwards. Good, soft-handling wool has a scale of medium length, smoothly fitted and suited to the size of the fibre, and apparently running round it instead of being narrow and pointed. This formation seems to regulate the flow of the yolk, so that it lubricates the fibre from base to tip. Wool of this nature handles softly, is lustrous, and very elastic.

The amount of curl in wool is not always a sign of quality. It is possible to get a poor-quality wool with a short curl; the open scales allow the fibre to turn abruptly, whereas a medium length scale will allow the fibre to turn only gradually.

The appearance of wool can be altered in a very short time by a change on to a different kind of soil. Both the curl and the yolk will alter, and in some instances this can be noticed in less than a month. A fairly rich, dry, clay loam will probably grow the most attractive wool. River-silt soils, and those formed from pulverized rock, will also grow a bright soft-handling wool, but not the same bulk as the clay loam. Rich papa country will grow a fleece of good weighty wool. Light soils of almost any description have a tendency to grow finer and lighter fleeces. Strong heavy clay land has the opposite effect. It will grow a strong wool with very little crimp and a lack of character. Limestone land, where the mineral is prominent, grows strong wool, hard to the feel, and with more of a twist than a curl.

Under ordinary conditions in the winter there is very little yolk flowing through the wool-fibre, and the fleece is apt to appear thin and fine. But when the spring sets in the fibre seems to swell and get much stronger and more solid. This effect is more noticeable on good land.

Rabbit Nuisance Act.—At its last meeting the Board of Agriculture decided to recommend that the Rabbit Nuisance Act be again consolidated, and approved of the proposals for the amendment of certain provisions of the Act relating to the establishment and working of Boards under Part III, which relates to the establishment of Rabbit Boards in reduced areas.

TOP-DRESSING OF HILL-COUNTRY GRASSLAND.

TRIALS IN WELLINGTON AND SOUTHERN HAWKE'S BAY DISTRICTS, 1925-26.

W. J. McCulloch, Instructor in Agriculture, Palmerston North.

For some years past it has been clearly apparent to sheep-farmers in certain parts of the North Island that the carrying-capacity of the hill country is declining, and it is safe to estimate on a conservative basis that the decline in many cases is equivalent to a third less stock than formerly. In these instances the decrease is not a result of secondary growth or bad management in stocking, but more strictly a matter of depletion of fertility, and the consequent succession or replacement of the previously sown English grasses by inferior or low-feeding-quality pasture-plants. On the greater part of such country the dominant pasture species to-day is either Danthonia pilosa or brown-top (*Agrostis tenuis*), with in some cases very sparse and stunted elements of rye-grass, cocksfoot, crested dogstail, white clover, and trefoil. In many instances careful search reveals only odd stunted roots of dogstail, with a very small proportion of suppressed white clover or trefoil, existing as remnants of a once vigorous and high-class pasture.

Investigation indicates that deterioration is chiefly confined to areas originally occupied by rain forest; so far, no significant decrease has been noted on other types of hill country in districts covered by this report. It is even suggested that, if anything, the reverse has been the case in connection with the non-forest areas, probably due to the unconscious and slow introduction of better-type pasture-plants through the agency of stock, &c.

The problem presented by a reduced carrying-capacity on the better-class hill country is certainly agitating the minds of settlers to-day and calls for immediate attention. Not only has production suffered during recent years, but it should be realized that it continues to decline. The breeder is conscious of greater difficulties in retaining sufficient bone in the flock, although his energies in this direction are greater than hitherto. Moreover, the percentages of fat lambs taken off the ewes have very markedly diminished. Although the gross revenue from meat and wool may have been greater in recent seasons of high prices there can be no doubt that the actual yields have lessened.

In the earlier stage of settlement the ashes and humus of the burnt forest provided sufficient fertility for a fairly lengthy period, but as, generally speaking, there has been no addition of fertility since, the ultimate result—inferior pastures—has inevitably followed.

Having regard to the foregoing main facts, an endeavour has been made by the Department of Agriculture during the past year (1925-26) to investigate the economy of top-dressing selected areas of hill country by hand. A total of twenty blocks of hill country over a wide range of varying types of pasture, typifying different degrees of deterioration, was selected. Under agreement the landholders were required to keep actual stocking records, also cost of application of fertilizers, &c.

Unfortunately, owing to the abnormally dry season in several districts and the consequent shortage of both grass and water, the stocking of some of the blocks could not be separated from the rest of the farm, and in such cases no definite data could be obtained. A number of the farmers, however, have supplied definite returns, while all are emphatic regarding the improved condition of the stock, and in most cases have volunteered the information that they intend treating further areas this coming season on their own account.

The first item of cost was transport from railway to farm. While some farms were close, and cartage as low as 3s. 9d. per ton, the cost for others at greater distance was as high as £2 2s. 6d. per ton. The average cost of cartage in twenty cases from railway to farm was 15s. 7d. per ton. In nearly every case the charges were for one-way freight, and it is admitted that these costs could have been lessened considerably if back-loading had been done in the wool season or other opportune time. The average cost of haulage from farm-steading to hill pasture was 15s. per ton; allowing wages at 14s. per day per man and 6s. for each horse, the average cost of applying (3 cwt. per acre) was 2s. 4d. per acre. The average area treated per man per day was 6 acres. The average total cost of top-dressing, including fertilizer at £7 per ton, handling charges, and application at 3 cwt. per acre, was £1 7s. 11d. per acre.

It will be noticed that in most of the experiments the fertilizer used was superphosphate alone; in the other cases Ephos phosphate was used alone.

All the farmers co-operating in the experiments have been asked to keep records of stocking during the present winter.

Following is a summary of individual areas treated where stocking records are available:—

JAMES ELLINGHAM, ORMONDVILLE.

The records of this experiment were very carefully taken. Two blocks adjoining each other, quite similar in pasture composition, aspect, &c., were compared, one being top-dressed with 2½ cwt. super per acre, while the other remained as a control (no manure). The fertilizer was applied on 6th July, 1925. Stocking records are from 13th July, 1925, to 14th January, 1926, for both blocks.

Breeding-ewes were carried on both blocks. The top-dressed block carried 1⅝ ewes per acre for the period, with lambs at foot, and $\frac{1}{10}$ cattle-beast per acre. The control block during the same period carried 1¼ ewes with lambs at foot and ⅛ cattle-beast per acre. The manured block showed an increase of 21 per cent. of fat lambs off ewes compared with the control. The wool-clip showed no significant increase. The composition of the pasture is rye-grass, cocksfoot, and dogstail, with a large proportion of Danthonia pilosa and some brown-top.

The cost of transport of manure from rail to farm was 12s. per ton; sledging on to ground, 1s. 1d. per cwt.; and distributing by hand, 7 acres per day per man; 2s. per acre. The cost of applying 2½ cwt. per acre by hand, including all handling from rail, was 6s. 2½d. per acre. Allowing superphosphate at £7 per ton, the total cost of the top-dressing was £1 3s. 8½d per acre.

A. TOMLINSON, RONGOMAI, EKETAHUNA.

The area of this block is 40 acres, and it was top-dressed with 3 cwt. of super per acre towards the end of June, 1925. The stocking of the area was with breeding-ewes. During the period 4th July, 1925, to 18th March, 1926, the carrying-capacity was 2½ ewes with lambs at foot. (No records of fat lambs produced.) The normal carrying-capacity is estimated at 1½ ewes per acre. The composition of this pasture is mainly brown-top and Danthonia pilosa. The cost of transport of manure from rail to farm was 15s. per ton; sledging and packing, 1s. per cwt.; and distributing by hand, 10 acres per day per man, 1s. 5d. per acre. The cost of application of 3 cwt. per acre, including all handling from rail, was 6s. 8d. per acre. Allowing super at £7 per ton, the total cost of the top-dressing was £1 7s. 8d. per acre.

A. K. GRIEVES, AOKAUTERE, KAIRANGA.

This block of 63 acres was top-dressed with 3 cwt. super per acre about the middle of September, 1925. A control block was used for comparison. During the period 8th November, 1925, to 31st March, 1926, the top-dressed block carried 2¾ ewes with lambs at foot and ⅙ cattle-beast per acre.

In the same period the control carried 1 ewe with lamb and ⅓ cattle-beast per acre. In the previous season the top-dressed block produced only thirty-seven fat lambs off the ewes; after top-dressing this season 120 fat lambs were taken off the ewes. The composition of this pasture shows considerable elements of rye-grass, cocksfoot, dogstail, and white clover, with some brown-top and danthonia, the whole in suitable condition to give good response.

Cost of transport of manure from rail to farm was 10s. per ton; sledging, &c., to hill, 2s. 4d. per cwt.; distributing by hand, 6 acres per day per man, 2s. 7d. per acre. The cost of application of 3 cwt. per acre, including all handling from rail, was 11s. 1d. per acre. Allowing super at £7 per ton, the total cost of the top-dressing was £1 12s. 1d. per acre.

C. C. HIGGINSON, WAIKANAE.

This experiment has been carefully recorded, and also the carrying-capacity of the block since 1921, together with that of an adjoining block during the period under review. Mr. Higginson supplies the following notes: "In the summer of 1924-25, after top-dressing, the feed did not come away well and the results appeared to be disappointing. I therefore fed the paddock off in January, 1925, with cattle, and cleaned everything up and kept it empty of sheep from 15th December, 1924, to 1st April, 1925. The rain in February, 1925, caused a wonderful growth, and on 1st April I began with sheep again, putting on eighty-four low-conditioned breeding-ewes. These were the backward ewes from the breeding-flock. They built up during winter and had 100 per cent. of good lambs, but these were not quite so good as the lambs off the ewes in the adjoining block (not top-dressed), that was carrying at the rate of 1½ ewes per acre with 95 per cent. of lambs. Two rams were running with the ewes on the top-dressed block from 1st April to 20th May. The stocking was with breeding-ewes mostly, with wethers, hoggets, and cattle at certain separate

periods, and the total period is taken from 1st September, 1924, to 8th May, 1925, for both sheep and cattle. Lambs running with ewes are not counted in the carrying-capacity. The top-dressed block carried $2\frac{1}{8}$ sheep and $\frac{1}{5}$ cattle-beast per acre for the total period, whereas the control block (not top-dressed) carried $1\frac{1}{2}$ sheep. The pasture is composed of Danthonia pilosa and brown-top, with a very little white clover, trefoil, Poa pratensis, and some cocksfoot. The country is very steep, and in this instance the manure had to be packed on to the ground. Super, at 180 lb. per acre, was applied in September, 1924. It is considered that the amount applied per acre was too small, and that up to 3 cwt. would possibly have shown better paying results, as cost of handling would not have been very much greater.

"The cost of cartage of manure from rail to farm was 6s. 3d. per ton; packing to hill, 2s. 1d. per 180 lb.; distributing, $5\frac{1}{3}$ acres per day per man, 2s. $7\frac{1}{2}$d. per acre. Cost of application of 180 lb. per acre, which includes all handling from rail, was 5s. $2\frac{1}{2}$d. per acre, allowing 14s. per man per day and 6s. per horse. Allowing super at £7 per ton, the total cost of the top-dressing was 16s. $8\frac{1}{2}$d. per acre."

W. MACKAY, APITI.

This block of 45 acres was top-dressed with 3 cwt. super per acre early in July, 1925. Breeding-ewes were carried. Mr. Mackay states: "The ewes had to be shifted off on 1st December owing to bid-a-bid, otherwise there was plenty of grass. From these ewes I sold 60 per cent. of fat lambs off their mothers at 36 lb. average weight. The average of the country here will only do from 1 to $1\frac{1}{4}$ ewes per acre on grass, but I am convinced from my experience up to the present that I would sooner run 2 ewes to the acre where top-dressed than $1\frac{1}{4}$ where not top-dressed. I feel sure one will not overestimate the value of top-dressing by putting it down at one ewe more to the acre for six months autumn and winter, and two ewes more for spring and summer, or an average of $1\frac{1}{2}$ ewes more per acre for the year."

The opinion arrived at by this landholder is borne out in the actual records of stocking. For the period 1st August to 31st March the carrying-capacity of the top-dressed block is 3 ewes per acre. In the same period the control carried $1\frac{3}{8}$ sheep per acre. The composition of the pasture is danthonia, brown-top, Yorkshire fog, and catsear, with a little cocksfoot, trefoil, and white clover, and in places a little dogstail.

Cost of transport of manure from rail to farm was £1 per ton, to hill 5s. 8d. per ton, and distribution per acre 2s. Cost of handling, at 3 cwt. per acre, was 5s. 10d. per acre. Total cost of top-dressing, allowing super at £7 per ton, was £1 6s. 10d. per acre.

GEORGE PORT, MOUNT RICHARDS ROAD, POHANGINA.

A block of 40 acres was top-dressed. In this case it is clearly shown by the records that every advantage was taken to utilize the experimental block as a fattening-paddock for both sheep and cattle, and Mr. Port contends that, apart from the fact that the block carried easily twice as much as any of the adjoining similar areas, it paid handsomely as a topping-off paddock. From the ewes carried

between 1st September and 18th December 72 per cent. of the lambs were sold fat off their mothers. This was followed by a further draft of ewes and lambs, and again a further percentage of lambs was turned off to the buyer. On 5th October twelve forward cows were put on and sold fat on 11th January. On 11th January a further eight cows were put on to top off and were sold fat on 11th February.

Super was applied at 3 cwt. per acre on 17th June. The composition of this hill pasture was still good, showing a fair amount of rye-grass, cocksfoot, and white clover, also considerable dogstail, with brown-top in damper portions and danthonia on the warmer spots. Compared with the adjoining block, it looked decidedly more vigorous even from a distance.

The owner states in the course of his remarks: "I am so pleased with the results that I have now top-dressed the adjoining blocks, and have spent £200 on manure for this purpose."

According to the records kept, the carrying-capacity of this block (between 24th August, 1925, and 26th April, 1926) was $2\frac{3}{4}$ sheep and $\frac{1}{4}$ cattle-beast per acre. It is considered that the carrying-capacity was double that of the adjoining block. Cost of transport of manure from rail to farm was £1 5s. per ton; sledging to hill, &c., 10s. 8d. per ton; distributing by hand, $4\frac{1}{2}$ acres per day per man, 3s. $1\frac{1}{4}$d. per acre. Cost of application, at 3 cwt. per acre, including all handling from rail, was 5s. 11d. per acre. Allowing super at £7 per ton, the total cost of the top-dressing was £1 6s. 11d. per acre.

FRANK W. PARRY, MOUNT BRUCE, MASTERTON.

In this case the appearance of the area indicated a badly deteriorated pasture, composed almost entirely of stunted, harsh brown-top with a little danthonia. No clover or trefoil was showing, but there was a fair amount of *Nertera depressa* weed, which always indicates lack of vigour and a poor sward. Recent examination showed clover and trefoil beginning to appear.

From the records kept the carrying-capacity for the period 15th July, 1925, to 30th April, 1926, was $2\frac{1}{4}$ sheep per acre, while the adjoining areas are reckoned as $1\frac{1}{2}$ sheep-country. Super was applied at 3 cwt. per acre early in July, 1925. Cost of transport from rail to farm was £1 per ton; from farm to hill, 5s. 10d. per ton; distribution by hand, $4\frac{1}{2}$ acres per day per man, 3s. 1d. per acre. Cost of handling, including distribution, was 6s. $11\frac{1}{2}$d. per acre. Total cost of top-dressing, including super at £7 per ton, was £1 7s. $11\frac{1}{2}$d. per acre.

THOMAS DUNN, IHURAUA, MAURICEVILLE.

The area of this block is 50 acres, and the composition of the sward mainly brown-top and danthonia. Breeding-ewes were carried during winter and lambed on the block. During part of January, owing to drought and shortage of water, the gates had to be opened into another block, which interfered with stocking records for a short time. From the records taken the carrying-capacity works out at $2\frac{1}{5}$ sheep per acre between 1st August and 6th April, while the adjoining block, not top-dressed, carried $1\frac{2}{3}$ sheep per acre for the same period. Super was applied at 3 cwt. per acre early in July, 1925.

Cost of transport of manure from rail to farm was £1 per ton; farm to hill, 13s. 10d. per ton; distributing by hand, 5 acres per day per man, 2s. 9¾d. per acre. Cost of application, 3 cwt. per acre, including all handling from rail, was 7s. 10½d. per acre. Allowing super at £7 per ton, the total cost of top-dressing was £1 8s. 10½d. per acre.

H. DENTON, LEVIN.

This block of 51 acres indicated a worn-out hill-country pasture, badly infested with *Netera depressa*. The sward was composed mainly of danthonia, with brown-top in places. Although the season under review was not favourable, the owner states that this was the first time for years that lambs on this hill had fattened on their mothers. He is further of opinion that the clover has certainly increased as a result of the top-dressing, although the paddock as a whole has not shown the amount of improvement hoped for, owing, no doubt, to the unfavourable season.

Super was applied at the rate of 3 cwt. per acre in the early part of July, 1925. Records of carrying-capacity between 1st August, 1925, and 31st March, 1926, work out at 1¾ sheep and $\frac{1}{7}$ cattle-beast per acre. The carrying-capacity on the adjoining country, not top-dressed, was 1¼ sheep and $\frac{1}{17}$ cattle-beast per acre.

Cost of transport of manure from rail to farm was 5s. 9d. per ton; farm to hill, 13s. 10¼d. per ton; distributing by hand, 6 acres per day per man, 2s. 4d. per acre. Cost of application, 3 cwt. per acre, including all handling from rail, was 5s. 3¼d. per acre. Allowing super at £7 per ton, the total cost of top-dressing was £1 6s. 3¼d. per acre.

F. S. FRANKLIN, MANGATUNA, DANNEVIRKE.

This block contained some 60 acres, and was top-dressed with 3 cwt. of Ephos phosphate per acre about the end of May, 1925. Writing on 10th April, 1926, Mr. Franklin states: "As you are aware, the season has been very dry for the last six months, and the fertilizer has not had much of a chance. Following are the details of stocking up to 10th January, at which date the water gave out, and we had to give the stock the run of the adjoining paddock. The usual carrying-capacity of this block before top-dressing was 98 ewes." According to the records given, the carrying-capacity after top-dressing, even in the past abnormal season, was the same; and on 3rd January a draft of fat lambs off their mothers, with an average weight of 32½ lb., was sold. The owner further states: "This was the biggest percentage we got away out of any paddock this year, and if the season had been normal this paddock would easily have carried another twenty-five to thirty ewes."

This owner had top-dressed a fairly large area of hill country in the previous year, and is again treating more country this season. The pasture is mainly danthonia and brown-top, with very scattered plants of cocksfoot and dogstail, a little white clover in places, and trefoil.

In this case cost of transport of manure from rail to farm was £1 15s. per ton; from farm to hill, 4s. 2d. per ton (sledging, &c.). Cost of handling from rail, including distribution by hand, 7½ acres per day per man, was 7s. 8d. per acre. Total cost of top-dressing, including Ephos phosphate at £6 10s. per ton, was £1 6s. 2d. per acre.

GEORGE BUCHANAN, WAITAHORA, DANNEVIRKE.

This block of 40 acres is purely brown-top, and was not by any means a palatable pasture, being a coarse, harsh growth with no sign of clover or trefoil. It was top-dressed during the last week in August, 1925, with 3 cwt. super per acre. Mr. Buchanan states: "As you know, the spring here last year was not favourable, so that, after feeding the paddock out with cattle from 1st September till 15th November, I only stocked it lightly with ewes during August and early September."

From 15th September, 1925, till 18th April, 1926, the stocking records work out at four breeding-ewes with lambs at foot per acre, and during the whole period $\frac{1}{8}$ cattle-beast per acre. Unfortunately, no definite comparison can be made, as details of the previous carrying-capacity of this block (likewise other adjoining blocks) are not full enough this season, no actual dates of shifting being available. As a comparison the owner states: "The adjoining paddocks carry about $1\frac{3}{4}$ breeding-ewes to the acre through the winter and until docking-time, when the dry ewes are taken out of them. Previous to top-dressing the paddock usually wintered from seventy to eighty ewes; these were lambed on it, and the dry ewes taken out at docking-time, generally about 20th September, or perhaps a week later."

In this case transport of manure from rail cost £1 per ton; sledging to hill, 17s. 4d. per ton. Cost of handling from rail, including distribution by hand at 4 acres per day per man, was 9s. 1d. per acre. Allowing super at £7 per ton, the total cost of top-dressing per acre was £1 10s. 1d.

G. H. HADFIELD, PARAPARAUMU.

The area treated in this case was 65 acres, which was top-dressed with $2\frac{1}{2}$ cwt. of Ephos phosphate per acre about the middle of July, 1925. The pasture composition was principally danthonia, mixed in places with brown-top. On a small area of one face rye-grass, cocksfoot, &c., were showing. Bracken fern had been troublesome on some of the steeper faces, but had been well worked with cattle some time previously.

The actual stocking records since top-dressing show that the area carried between 25th July, 1925, and 18th March, 1926, at the rate of three breeding-ewes and $\frac{1}{3}$ cattle-beast per acre. Unfortunately, the previous stocking records for the block are not complete, and therefore a comparison is not possible for a corresponding period.

The cost of transport of manure from rail to farm was 13s. 6d. per ton; farm to hill, £1 1s. per ton. Cost of application, at $7\frac{2}{3}$ acres per day per man, including all handling, was 6s. $2\frac{3}{4}$d. per acre. Allowing Ephos phosphate at £6 10s. per ton, the total cost of top-dressing was £1 2s. 6d. per acre.

MAX SPEEDY, NGAPAERURU, DANNEVIRKE.

This area of 80 acres was top-dressed with $2\frac{1}{2}$ cwt. of super per acre in July, 1925. The pasture is composed almost entirely of danthonia, with brown-top in the damper shady spots. Comparison is drawn between the previous year's stocking of 125 ewes on this block, which runs out at slightly about $1\frac{1}{2}$ breeding-ewes per acre, as against $2\frac{1}{4}$ breeding-ewes, after top-dressing, for the period 29th August,

1925, to 14th May, 1926, and the handicap of an unfavourable season. Mr. Speedy points out that he sold 17 per cent. of the lambs off their mothers, but adjoining paddocks did not produce any, and that although this has been a very dry season the top-dressed country kept longer green than the untreated pasture, and showed greater improvement when spelled. Cattle, at $\frac{1}{18}$ head per acre, were also carried during the same period. The cost of all handling of manure from rail and distribution of $2\frac{1}{2}$ cwt. per acre was 7s. 5d. per acre. Total cost of top-dressing, including super at £7 per ton, worked out at £1 4s. 11d. per acre.

CLIFFORD ADKIN, LEVIN.

According to the owner, this block had carried well over $1\frac{1}{2}$ sheep per acre until about three years ago, when the carrying-capacity decreased very fast, coming down to less than one sheep per acre; but since top-dressing it has been carrying three sheep per acre (hoggets and ewes mixed), also a small line of yearling heifers. The cost of handling of manure in this case works out at 4s. 8d. per acre, including transport from rail and application at the rate of 3 cwt. per acre. The total cost of top-dressing, allowing super at £7 per ton, was £1 5s. 8d. per acre.

WEEDS AND THEIR IDENTIFICATION.

(Continued.)

CAPER-SPURGE (*EUPHORBIA LATHYRUS*).

ESMOND ATKINSON, Biological Laboratory, Wellington.

CAPER-SPURGE has not been scheduled under the Noxious Weeds Act, and—speaking strictly from the farmer's point of view—is of no very great importance. It is not a weed of grassland or of cultivated crops, being found chiefly in the waste places that occur in gardens and along roadsides.

Though caper-spurge is now naturalized from one end of New Zealand to the other, it is of very local distribution, and there are large areas where it is not to be seen at all, or is perhaps only represented by an odd plant here and there. In Cheeseman's Manual it is stated to be found in the "North and South Islands: Waste places; in rich, warm soils; not common."

Caper-spurge has been included in this series because it possesses undoubted poisonous properties, and is often sent in for identification as a "suspected plant."*

DESCRIPTION.

Caper-spurge is a smooth annual or biennial herb, up to 4 ft. or so in height, and decidedly blue-green or glaucous in colour.

The stem is generally unbranched and erect below, and is there clothed with long narrow leaves 3 in. to 5 in. long, the lower ones being turned back (see illustrations). Above, it is umbellately branched—

* The writer would here like to express his thanks to Mr. T. H. Broom, of Ashburton, who kindly sent carefully packed specimens of the plant, from which the accompanying drawing was made.

that is, all the stalks spring from the same point. A piece of one of these stalks is illustrated, and shows the heart-shaped floral leaves or bracts. These are set opposite one another, and are very conspicuous through the complete difference of their shape from that of the stem-leaves below.

FIG. 1. CAPER-SPURGE.

Plant (divided for photographic purposes) showing characteristic branching and difference in shape of lower stem-leaves (right) and floral leaves (left).

[*Photo by H. Drake.*

In each of these pairs of bracts what looks like a single flower is borne, but it is really a cluster of several male flowers and one female, the whole cluster being surrounded by a greenish cup called an involucre. No drawing has been made of these flowers, and they will not be further described, because their small size makes it impossible to correlate them satisfactorily with any description except with the help of a magnifying-glass.

FIG. 2. CAPER-SPURGE.

(*a*) Branch with capsules; (*b*) lower part of stem in outline—both natural size; (*c*) seeds, natural size and magnified.

[*Drawing by E. H. Atkinson.*

The flower-cluster is soon followed by a very conspicuous, roundish seed-capsule ½ in. or more in diameter, which, when it is ripe, splits into three valves, each valve being itself deeply divided longitudinally, so that the capsules have the appearance of being six-valved. The shape and size and the markings of the seeds are better indicated by the illustration (*c*, natural size and magnified) than by description.

POISONOUS PROPERTIES.

All parts of caper-spurge are full of a milky juice, which possesses very acrid properties and causes irritation and blisters wherever it touches the skin; but it is the seeds that are the most dangerous, as they contain a violently purgative oil. These seeds have long been used medicinally in many European countries—twelve to fifteen being the usual dose on the Continent—so that it is not rare to hear of cases of poisoning as the result of an overdose. The symptoms are given by the United States Farmers' Bulletin No. 86 as inflammation of the mouth and stomach, and intense diarrhœa and vomiting. If the dose is sufficient there will be nervous disorders, unconsciousness, general collapse, and death.

Cases of stock-poisoning are fortunately rare, as it is said that only young animals will touch the plant, and these only when it is in its earliest stages. Stock as a rule may be said to avoid caper-spurge. When, however, it is eaten the symptoms are similar to those described in the case of human beings.

POSITION AS A WEED.

It may be thought by some reading these notes that a plant so little likely to cause trouble in New Zealand is hardly worth including in this series. However, the probability of the attractive-looking capsules being eaten by small children—who are quite likely to come across the plant—seems to justify an illustrated account being given of it.

Little need be said about control methods—there is no systematic way of dealing with a weed of this type—but it would certainly be wise to make a general rule of pulling up every plant of caper-spurge that is seen.

CLASSIFICATION OF TALLOW FOR EXPORT TO BRITAIN.

In regulations gazetted last year by the British Ministry of Health it is provided that lard, dripping, edible tallow, and similar rendered fats must have a certificate attached to each container of same if it is desired to introduce this commodity into the United Kingdom as "edible." The certificate issued by the New Zealand Department of Agriculture is to the effect that the material is derived from carcases free from disease, and prepared and packed with all necessary precautions for the prevention of danger to public health, &c. For this reason it is obvious that the Department cannot furnish a certificate to cover consignments of farm or butchers' tallow should such certificates be applied for, the certificate being reserved only for the best grades of tallow that are considered fit for human consumption. The shipping of other tallows is, of course, not prohibited, but they are consigned uncertificated.

Noxious Weeds Orders.—The Mackenzie County Council has declared St. John's wort *not* to be a noxious weed within that county.

A CASE OF LEG LESIONS IN RAM HOGGETS.

C. S. M. HOPKIRK, B.V.Sc., Officer in Charge, Veterinary Laboratory, Wallaceville.

IN October of last year an interesting condition, which it seems desirable to place on record, was recorded in a flock of purebred Romney ram hoggets in the Wairarapa district.

The sheepowner first noticed that some of the animals showed a bleeding patch between the accessory claws of the hind legs, and as a number of the rams in a flock of 550 were affected he called in Mr. T. A. Blake, Government Veterinarian, Masterton. Mr. Blake, later, brought a ram alive by motor-car to this Laboratory for experimental work. In the majority of cases the two hind legs were affected, but several had the fore legs more or less acutely affected, and an odd animal the corners of the lips. The condition commenced as a small raised area of skin, which soon sloughed off, leaving a raw bleeding patch about the size of a threepenny piece. Some days later this had grown to the size of a half-crown, and was in some cases dry and scabby, but usually broken and bleeding from the driving of the sheep for examination. Occasionally the lesions had progressed down to the heels and round the coronets, but this was unusual. Each sore was a surface condition, and did not produce lameness in any one case—in fact, the rams fed well and lost no condition, being large forward animals. At the Laboratory a lesion was easily dissected off under a local anæsthetic, leaving smooth, healthy subcutaneous tissue which quickly healed over. The time between a sheep becoming affected and the natural healing-up of the lesions was in the vicinity of from three to four weeks. Only ram hoggets were affected.

The country upon which the sheep were running was excellent old-standing sheep land. Much of the area was flat and very well watered, bordering a lake. The remainder was hill country, where there was plenty of good grass. It will be realized that the weather during the winter had been exceedingly wet, and feed was growing in abundance, but was still soft. The rams had been running on turnips for a fortnight in August, and had then been distributed in small lots over a number of paddocks to get full benefit of the excellent pasture. Once the trouble was noticed a number were placed on the hill country, but these also became affected.

The ram brought to the Laboratory gave material for experimental work, and sections from the lesions, the organisms present, and the development of the lesions were all carefully examined. By scarifying the surface of the skin of the pastern or of the thigh, and introducing a small amount of the infected material from the affected ram, one was able to show that the organisms present would cause similar lesions on rams, lambs, wethers, or ewes, anywhere on the skin, but that before the lesion developed there had to be some injury to allow the entrance of the infective organism. This was considered to be *Bacillus necrophorus*, an inhabitant of many soils where animals have been pasturing for any length of time. In December, as two lots of rams which had not previously been noticed affected were commencing to show lesions, it was decided to thoroughly examine the state of the run, the condition

appearing to be of the nature of a contagious disease. Mr. Blake and the writer spent some time going over the run and the infected animals.

The following possibilities presented themselves :—

(1.) Result of feeding on turnips : As it was some time after coming off turnips that the sheep were noticed to be affected, and although they were together for the last time on these roots, it did not seem possible to implicate turnip-feeding.

(2.) Thistles : There were a few thistles with the turnips, but, as ewes were also run on the same land and were not affected, one could not blame thistles for causing the original injury whereby the necrosis bacillus gained entrance.

(3.) Ergot : This was not present to any extent on seeding heads of the grasses, nor did the lesions resemble known ergot lesions in cattle.

(4.) Bruising of posterior surface of fetlock on rough paddocks made boggy by cattle and later hardened by the sun : The paddocks were in splendid order and had few cattle running on them, thus ruling out bruising.

(5.) Inbreeding and lack of stamina : This was not a factor, because of the constant new blood brought into the flock.

As none of these possibilities could be considered causative a thorough examination of two paddocks of rams was undertaken, each animal being caught and thoroughly examined for fore-leg, mouth, and hind-leg lesions. While examining the mouths it grew more and more noticeable that only rams with their two teeth erupting were showing lesions. Where teeth had come through early no lesions had developed nor healed, and where teeth were commencing to erupt the lesions were only commencing. This fact became so striking that one could tell from the teeth what to expect on the legs.

The explanation of the whole trouble appears to be as follows : The pasturage had been so soft throughout the earlier part of the season, when the rams should have been teething, that no help had been given the teething process. Teething was therefore exceptionally late in the whole flock, and to a large extent throughout the locality. Ewes on rougher feed had commenced teething somewhat earlier. The rams were in forward condition, and had been so well flushed that they undoubtedly had a mild fatty infiltration of the liver, which would prevent that organ dealing thoroughly with poisons developed as a result of teething. Further, the kidneys of young sheep fed excessively often fail to act in eliminating these poisonous materials of the blood (the extreme condition being pulpy kidney of lambs), so that the skin is called upon to act in place of the kidneys. A rash will then develop. As supporting this theory it was noticed that many of the rams had a pustular rash over the scrotum and down the thighs where it could be noticed, and even beneath the hair of the legs when these were carefully examined. A rash indicated an injured skin-surface where the necrosis bacillus could attack. The country having run sheep for many years, necrosis bacilli were present everywhere and accepted the opportunity given them for attack. It therefore seems to be quite feasible that late teething had led to the appearance of the leg lesions in these rams.

IMPORTATION OF FERTILIZERS.

ANNUAL STATISTICS, 1925–26 AND 1924–25.

Chemistry Section.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1926, have been prepared as usual from figures specially supplied by the Comptroller of Customs, and are presented in the accompanying tables, together with similar data for the preceding year for comparative purposes.

TABLE 1.—SUMMARY OF FERTILIZER IMPORTATIONS, 1925–26 AND 1924–25.

Fertilizer.	Quantity.		Declared Value.	
	Year 1925–26.	Year 1924–25.	Year 1925–26.	Year 1924–25
	Tons.	Tons.	£	£
Bonedust	2,085	2,452	18,851	23,210
Bone-char	309	396	1,270	1,756
Basic slag	44,314	45,682	139,136	137,213
Superphosphate	500	10	1,856	29
Nauru and Ocean Islands phosphate	77,797		98,827	
New Caledonia phosphate ..	11,784	108,163	22,217	150,340
Seychelles Islands phosphate ..	7,907		12,055	
Egyptian basic phosphate ..	10,037	8,530	32,363	25,313
Nitrogenous guano	20	..	236	..
Kainit	3,110	4,001	8,214	9,137
Muriate of potash	25	2	145	17
Sulphate of potash	1,356	1,126	13,728	11,574
Potash, other	4,238	2,287	16,749	8,321
Gypsum	1,402	354	2,220	574
Sulphate of ammonia	1,227	841	17,037	13,158
Nitrate of soda	1,284	816	16,033	9,751
Sulphate of iron	67	96	743	1,043
Fertilizers unspecified	..	12	247	1,371
Totals	167,462	174,768	401,927	392,807

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1916–26.

Year ended 31st March,	Bonedust.	Basic Slag.	Superphosphate.	Pacific and Indian Oceans Phosphates.	Egyptian Basic Phosphate.
	Tons.	Tons.	Tons.	Tons.	Tons.
1916	10,059	10,339	58,013	39,366	2,026
1917	10,386	6,660	31,962	24,993	8,614
1918	6,363	10	37,157	37,037	11,225
1919	3,468	Nil	21,400	31,351	Nil.
1920	6,272	2,759	15,842	38,861	15,000
1921	4,440	10,823	40,731	70,208	10,810
1922	4,063	13,488	3,140	45,956	Nil.
1923	2,446	19,641	Nil	69,591	,,
1924	4,158	39,632	255	76,517	5,996
1925	2,452	45,682	10	108,163	8,530
1926	2,085	44,314	500	97,488	10,037

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR ENDED 31ST MARCH, 1926, SHOWING COUNTRIES OF DEPARTURE AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.			Chile.	India.	Pacific and Indian Oceans Islands.		United Kingdom.			Belgium.		France.		Germany.		Egypt.	Netherlands.
	Nitrogenous Manures.	Bonedust and Bone-char.	Gypsum.	Nitrate of Soda.	Bonedust.	Name of Island.	Rock Phosphate.	Nitrogenous Manures.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Phosphate.	Super-phosphate.
						New Caledonia ..	2,821	..	..	..	..	..	..	..	..	..	..	..
Auckland ..	474	583	1,000	1,218	1,600	Seychelles ..	3,576	200	6,859	1,075	12,581	117	150	1,559	20	2,787	1,518	..
						Nauru	53,978	..	..	..	..	..	..	..	..	..	..	..
						Ocean	7,012	..	..	..	..	..	..	..	..	..	..	..
New Plymouth ..	20	..	..	..	..	New Caledonia ..	620	..	5,749	175	9,730	..	..	250	..	121	..	..
						Nauru ..	3,047	..	..	..	..	..	..	..	..	..	..	..
Wanganui ..	5	..	..	..	..	New Caledonia ..	2,323	..	..	..	..	..	..	..	..	..	..	..
Napier ..	..	..	..	..	..	..	..	..	..	5	100	5	..	..	..	..	994	..
Wellington ..	40	..	..	25	25	..	..	..	3,465	65	3,345	115	..	460	..	155	3,020	..
Nelson ..	..	..	..	..	..	..	..	..	300	20	55	..	..	30	..	125	..	..
Lyttelton ..	320	..	..	..	..	Seychelles ..	1,690	..	5	70	60	..	..	335	..	20	1,500	..
						Nauru ..	5,071											
						New Caledonia ..	1,223											
						Ocean	4,104											
Timaru ..	..	..	..	..	..	New Caledonia ..	779	..	..	25	..	..	..	..	..	..	..	..
						New Caledonia ..	2,710	..	..	..	..	..	..	..	..	..	..	..
Dunedin ..	65	..	402	..	..	Nauru ..	2,840	..	200	10	70	..	..	280	..	75	904	..
						Ocean	1,455	..	..	..	..	..	..	..	..	..	..	..
Invercargill ..	83	186	..	10	..	Nauru	690	1	425	25	1,200	..	..	395	..	405	2,101	500
						New Caledonia ..	2,148											
						Seychelles ..	1,386											

NOTE.—For corresponding statistics for year 1924–25 see *Journal*, May, 1925.

WATER-HYACINTH IN NEW ZEALAND.

INFORMATION has been received that water-hyacinth (*Eichornia speciosa*) —which belongs to a small family of water-plants not in any way related to the true water-lilies—is being introduced into the Waikato district and there sold as an ornamental flower for growing in lakes and rivers. It has for many years been established on a small scale in several different parts of the North Island, and while in some cases but little trouble has arisen, in others great regret is expressed that it was ever planted.

Water-hyacinth is a plant of extreme beauty, and it is natural enough that those who possess suitable sheets of water and who have not heard of its evil reputation as a weed in other countries should look on it as a great acquisition. Before water-hyacinth is in any way encouraged or distributed about the country, however, it should be remembered by those concerned that it is a plant capable of growing on the surface of water, and, under favourable conditions, of quickly covering large areas to the extent of making them impassable even for steamers on large open streams. Immense sums have been spent in the warmer parts of North America and Australia in keeping waterways free from the weed. While it is quite true that many parts of New Zealand are too cold for the plant—which, it is reported, cannot stand frost—it should be emphasized that so little is known at present about its behaviour in this country in a wild state that the wisdom of taking all possible steps to prevent its further distribution must be obvious.

The matter is being taken up officially, and the Department of Agriculture will be glad to hear of any details, such as the presence of the water-hyacinth in any locality and its behaviour there. An illustrated descriptive article and report on its local distribution will appear in a later issue of the *Journal*.

IMPORTATION OF PRODUCE FROM THE UNITED STATES.

IN accordance with the promise made when the embargo was first imposed against the importation of agricultural produce from California, Washington, and Oregon, that due notice would be given of any proposed modification of the regulations, the Minister of Agriculture announces that, provided no fresh outbreak of foot-and-mouth disease occurs in the meantime, it is the Government's intention to modify the regulations as from 1st August, 1926, to permit of the introduction of the seeds of flowers, vegetables, grasses, clovers, and trees—(*a*) grown in States other than Texas and California, upon production of a certificate signed by the consignor indicating the State in which the seed was grown, and (*b*) grown in California or Texas, upon production of a certificate signed by the consignor to the effect that the seed is the produce of California or Texas, but was not harvested prior to 1st April, 1926.

Dehorning of Cattle.—This question was further considered by the Board of Agriculture at its last meeting. It was decided to report to the Minister that the time had arrived when a Bill should be brought in to make dehorning compulsory, except in the case of stud and pedigree cattle.

SEASONAL NOTES.

THE FARM.

LIMING.

LIMING of land—more especially in the form of pasture top-dressing—should be completed during July if its beneficial effect is to be shown in the ensuing spring. The result should be reflected in better pastures, in that one of the main effects of lime is the encouragement of desirable grasses and clovers and the depression of undesirable weeds. When lime is applied to arable land it should be broadcasted and worked into the soil in course of the final tillage.

On heavy, raw types of soil ground burnt lime can be advantageously used, a dressing of 10 cwt. to 15 cwt. per acre generally sufficing. On the lighter types of land finely ground carbonate of lime is to be recommended at 20 cwt. to 30 cwt. per acre. For general purposes 18 cwt. of carbonate of lime is equivalent in calcium to 10 cwt. of burnt lime. It will therefore be appreciated that where carting has to be carried out over long distances burnt lime is economical.

For low-lying, stiff subsoil land some system of under-drainage, followed by liming at the rate suggested, is a practice of much merit. The scheme could be conveniently worked if 15 to 20 per cent. of the farm area were limed each year. This would increase the area of the winter grazing considerably, and at a cost within reach of the average farmer.

Though more difficult to handle than carbonate, burnt lime, of course, gives quicker results. Especially is this the case on heavy land and land rich in humus and organic matter. The quicklime helps to free and open up the texture of the heavy land, and also has a warming effect on naturally cold soils. It also acts on the humus and organic matter in the soil and converts it into an available form of plant-food.

Where lime is applied as a top-dressing to grassland, farmers should bear in mind the necessity for following it up by an application of phosphate in the spring.

DRAINAGE.

Money spent on applying lime and fertilizers to badly drained country is money more or less wasted. Where land lies long in a sodden condition good under-drainage will show up to advantage, purely surface drainage not being sufficient. Under-drainage, where it is possible, removes the surplus moisture to the depth of the drainage-system, permits earlier cultivation, and ensures a reasonable absorption of heat in the early spring, hence earlier spring growth. Surface drainage removes only excess surface moisture and not the surplus of water already in the soil. If excess soil-moisture is not removed by under-drainage, then it remains in possession of what should be air-spaces, and must subsequently be removed by evaporation. This is a slow method and very wasteful of early spring heat,

hence the later growth and a longer hold-up of cultural operations. Moreover, increased aeration of the soil means greater activity of the nitrogen-fixing bacteria and consequent increase of plant-food.

Where the subsoil is firm and the fall of the land suitable mole draining is often the quickest and most economical method of bringing about better conditions in so far as excess moisture is concerned. In drain-ploughing it is necessary to make provision for the rapid get-away of water from the outfalls. In Southland mole drains are frequently drawn at about 10 ft. apart, but distance is governed by soil conditions and the draining-capacity.

PASTURES.

Harrowing of pastures should be completed during the coming month, likewise any proposed top-dressing, if results are to be expected early in the new season. Only quick-acting or fairly-quick-acting manures, such as super, basic super, or a mixture of lime and super, should now be applied for this purpose.

One or two top-dressed and harrowed paddocks should now be selected and shut up for early calving-cows and early lambing-ewes. There is nothing better for these animals than a nice clean pasture.

CULTURAL NOTES.

Where intended wheat crops have not been sown by about the middle of June it is as well to postpone the operation until August.

Ground in which it is intended to sow peas for commercial seed crops should be well prepared in July for August sowings. In Marlborough top-dressing of the ground in July has been shown to be better than applying manure with the peas when sown.

Clover stands to be saved for seed should receive a minimum of cultivation during the first year. In the second year an occasional stroke with light harrows prior to shutting up in August will in many cases prove beneficial. Superphosphate, at about 2 cwt. per acre, should be applied before the beginning of August.

Where no fresh young pasture can be made available for ewes and lambs, a sowing of 3 bushels oats with 5 lb. to 6 lb. mustard per acre will provide quickly grown early feed.

Catch-crops intended for green-manuring should be ploughed in during the coming month so that the material may decay before the sowing of spring crops.

MISCELLANEOUS.

When roots are badly affected with rot, it is advisable that they be fed out on some permanent-pasture field which will not be cropped for three or four years at least. This will minimize the danger of reinfection. Stock from diseased areas should not have access to fields which it is intended to crop. The same applies to pigs grazing over the farm. If they are wintering on diseased artichokes they should not have access to any proposed new artichoke area, otherwise infection will probably reappear.

Ensilage may with advantage be fed to yearling cattle, which often winter badly. A ration of 10 lb. to 15 lb. is considered sufficient.

Where gorse or broom has been allowed to spread on the farm many days not suitable for other work could be profitably occupied in grubbing it out. It is the well-kept farm that is sought after, and the work of clearing such weeds may be regarded as profitable as well as necessary. —*Fields Division.*

THE ORCHARD.

PRUNING OF APPLE-TREES.

THERE are large numbers of apple-trees throughout the Dominion ranging in age from seven to fourteen years. Much has been written on the subject of pruning which is very helpful, but one meets with many instances where pruners of very little practical experience have followed too closely the theoretical rule laid down for the training of fruit-trees, but with no trees of mature age to guide them. Consequently production in many cases has been retarded, and in others trees have been ruined by overproduction before they were ready for the burden imposed on them. I would advise those who still have younger trees to study the older trees before putting the secateurs into operation on the former, as there are few of us who cannot learn something from the natural habit of the tree, and it is often from the cut that we did not intend to make that we learn the most.

The Jonathan.—Going back to the earlier days of the Jonathan I remember how it was mostly deprived of all side shoots right to the base, from which, unless exceptional vigour was maintained in the tree, no further shoots resulted; and to-day can be seen many evidences of bare foundations, with the bulk of the fruit borne higher up the branches, denoting the time when experience taught that the earlier method was not the one to follow. To-day we know that in order to keep the Jonathan a regular bearer we must produce new wood annually, and utilize it to provide new buds on two-year-old wood as well as on bearing-laterals. In the treatment of yearling wood we have also learned that to retain growth we must not depend on the first one or two half-developed buds for our wood-shoots, as on trees of moderate growth a dead stub will usually result. A plump bud must be left at the terminal if extension of growth is required from this source; and for the production of fruit two years hence a sufficient number of buds must be left, according to the strength of the wood-shoot, to ensure continuity of growth and provide room for fruiting-buds between these and the last year's cut. In the case of trees on which growth is diminishing, whether it be leaders or side shoots, one should not hesitate to cut back to a stronger shoot, as by doing so vigour will be imparted to the whole branch and probably save more drastic treatment in a year or two hence.

The Delicious.—What huge crops of this variety were conjured up in the minds of growers from those strong-growing straight-limbed young trees. Looking back at many of them to-day I recall how many pruners tried to subdue them into cropping by continuously severing all their annual growths off to the base, leaving only so many shoots as were considered necessary to form the framework, from which would again arise a multiplicity of shoots which could have been used

much earlier for fruit-production than in many instances they were, and with greater profit to the grower. In many instances the Delicious trees have actually been subdued into cropping by summer pruning, but I venture to think had a voice whispered "Oh, woodman, spare that tree" a few years earlier the result, regarding both tree and crop, would have been in the owner's favour.

In training the Delicious to-day I would say, Get your foundation and framework as soon as possible, according to the vigour of the tree; utilize the weaker growths for fruit-production as so n as they become available; and after the trees get up to the sixth year, if growth is still vigorous and the trees disinclined to set fruit, allow some of the well-spaced stronger growths to develop without pruning. It will then be found that fruit-buds will abound for the next year, and the girth of the shoots will be greater than if they had been pruned. The next season the cut should be made above the two-year-old wood, leaving several buds of the yearling wood for the continuation and subdivision of the branch, after which a little study of the particular shoots will decide the course of action to adopt. As with all other trees, however, this system of modified pruning can be overdone in the Delicious. I would warn pruners that such a method is only good for strong-growing trees, and if applied to weak-growing trees it only results in overburdened branches—all fruit and no wood-growth — which will have to be rectified sooner or later by drastic deletion to restore the vigour, without which the fruit produced will soon deteriorate both in size and quality.

WINTER SPRAYING.

The spraying of pip-fruit trees during winter against insect pests and fungous diseases is sometimes practised by orchardists. Personally I consider the winter the least favourable time to engage in this work, for the reason that materials such as oil sprays and lime-sulphur washes are the least efficient during cold weather, and require stronger dilutions to attain their object. Again, most fungous diseases from which pip-fruit trees suffer are quiescent during the colder months. Likewise the living insects are better secreted to withstand the cold, and their eggs are in a condition to withstand exposure to a greater degree than in the spring-time. From these considerations spraying is best delayed until the early spring, unless circumstances are such that the work cannot be delayed.

—*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

Throughout this coldest part of the year citrus-trees will require protection against stagnant water in the soil, and, in the case of young trees, against frost damage. Every attention should therefore be given to surface drainage in order to remove surplus water, and light-scrim protection should be afforded to young trees in very exposed situations.

Shelter-belts may be trimmed and new shelter planted as required. Land should be prepared for new plantations. Lemons and Poorman oranges should be harvested as ready.

—*W. H. Rice, Orchard Instructor, Auckland.*

THE APIARY.

MOVING OF BEES.

At this season of the year bees may be moved to a new location with perfect safety. If the work is left until spring, when the activities of the hive commence, the resultant loss of field-bees will be enormous. More especially should advantage be taken of the bees' dormant condition if the hives are to be moved short distances only. The colonies are numerically weaker, and there is usually little brood to become injured in transport. When hives are located for any length of time in one position the flying bees take full observation of every landmark, but as in the winter there are shorter periods of sunshine the flight of the bees is necessarily curtailed, and they usually return at a much shorter distance from the hive. In addition, there are often periods of several days together during which they take no flight at all, and in consequence they must renew their acquaintance with their surroundings when an opportunity for flight occurs. Therefore, if the hives are moved during a spell of bad weather the bees will take more readily to their new location when a fine day comes. Any bee-shifting operations should be completed before the end of July.

To secure bees for transit over a short distance sufficient ventilation can be provided by tacking a piece of wire gauze over the hive-entrance. It is then only necessary to secure the bottom and roof, and, after making sure that there are no holes through which the bees can escape, the hive may be carried with safety.

The successful moving of bees over long distances calls for considerable preparation. All heavy combs should be secured, and only sufficient honey left in the hives to prevent the bees from starving during their journey. The most important factor is ventilation, and neglect of this matter leads, as a rule, to heavy losses when bees are being moved. The constant vibration of any vehicle tends to disturb the cluster, and the excitement caused thereby is sufficient to raise the temperature of the hive considerably, so that the bees are in danger of being suffocated and the brood scalded. These troubles can be avoided by the employment of wire screens. First see that the frames are made as secure as possible by inserting two wedges between the side of the hive and the top of the end frames. This prevents the frames from rocking during transit. The bottom-board should then be secured to the hive-body by means of crate-staples, driving one end of the staple into the hive-body and the other into the bottom-board. Usually six staples are sufficient. The screens can be made by using narrow laths nailed together to form a frame of the same dimensions as the hive-body, and covering this with wire cloth such as is used for making queen-cages. The screens must be securely fastened to the top of the hive and the entrance covered with wire cloth. By this means ample ventilation is provided to ensure the safe carriage of the bees during the winter months.

In these days of motor transport the work of moving bees over long distances is greatly minimized, and the beekeeper will be well advised to adopt this method if it can be obtained. In any case the beekeeper who has occasion to move bees should not relax any effort to make the hives secure when moving to a new location.

CONDITION OF HIVE MATS.

At intervals during the winter months the mats should be examined to note their condition. After heavy rain the mats are liable to become damp, and should be removed and dry ones substituted. To save delay a supply of dry mats should always be kept on hand. As far as possible do not disturb the colonies when making an examination, and especially avoid jarring the hives. The roof can be carefully lifted and the mat examined. If the latter has to be removed see that the smoker is handy in case the bees are troublesome, but do not use smoke unless the bees have to be driven down. Remove the wet mat as speedily as possible, replace it with a dry one, and cover the hive.

LEAKY COVERS.

Damp mats usually point to defects in the covers, and it should be worth the beekeeper's while to remove these also. At all seasons the comfort of the bees should be one of the main considerations, and this factor cannot be ignored if successful wintering is to be expected. The labour involved in keeping the hives watertight will repay their owner many times over, and prevent to a large extent the loss of heat generated by the bees. One should aim at reducing the waste of energy of the bees by maintaining the heat of the cluster at an even temperature during the unproductive season, and this will be impossible where leaky roofs are tolerated. Successful wintering is a high test of the beekeeper's capabilities.

PERMANENT SHELTER.

Now that the actual work of the apiary is off the beekeeper's hands for a while he may devote his attention to the matter of providing permanent shelter for the hives. If he has definitely decided on a permanent location for the apiary he should now set about the cultivation of a quick-growing hedge. This matter is a most important one, and ranks next to that of locality. It is noticeable in sheltered situations that the bees are able to take cleansing flights during the mild days of winter, whereas bees in unsheltered positions are often confined to their hives even on sunny days. An occasional flight in the winter is as necessary for the welfare of the bees as any provision the beekeeper can make for their comfort. In addition to protecting the bees during the winter from stormy winds, it is an incentive to increased brood-rearing in the spring and early summer.

Whatever shrubs or trees are provided for the purpose of producing a permanent hedge, they should be planted thickly, and trimmed to produce abundant foliage, especially at the base. It is highly important that the plants shall stand cutting-back, so that the hedge can be kept at a reasonable height. Hedges grown to a height of 8 ft. to 10 ft., and no higher, will provide ample shelter for a large apiary. There will also be less trouble in taking swarms if the trees are kept to the height indicated. Locality and situation must to a large extent influence the beekeeper in choosing the most suitable plants, but, whatever the hedge, the idea should be to form thick shelter and not a plantation.

—*E. A. Earp, Senior Apiary Instructor.*

POULTRY-KEEPING.

MATING THE BREEDING-BIRDS.

THE busiest season of the year and the most important one—that of hatching and rearing young stock—is now near at hand. Thus no time should be lost in getting the breeding-birds mated and the hatching operations under way.

It is always a good plan to have some July-hatched pullets, as these will lay during the autumn at the time when fresh eggs command high values. Such early-hatched stock will mostly moult before the winter season sets in. Nevertheless, if well fed and managed they will give a good return of eggs just when the adult stock are commencing to take their period of rest prior to moulting, and when the returns of the average poultry-keeper commence to decline. Of course, the main flock of pullets intended for winter laying should be brought out some time in August or September.

Those poultry-keepers who have acted in accordance with the advice given previously in the *Journal* will have selected and carefully marked the best breeding-specimens during the late autumn, or, in other words, before the birds moulted. The poultry-keeper who has failed to do this may expect a large percentage of culls and unprofitable stock. The time is opportune to reiterate the advice that too much care cannot be taken in making the final selection (even where the late moulters are concerned) so that no bird is placed in the breeding-pen unless it is healthy and conforms to the standard-weight clauses of its respective breed, lays at least a 2 oz. egg, and, above all, possesses undoubted constitutional vigour.

From now onward to the end of the breeding season the hens should be treated in a manner conducive to their being in the best condition to produce eggs containing good fertility and strong germs. This implies that they should not be forced for eggs by the oversupplying of animal or other forcing food. The plainer the ration the better will the results be, provided a variation of grain foods is supplied and an abundance of green material. Exercise is of special importance for hens that are producing eggs for reproductive purposes. It should be induced as much as possible by making the birds scratch for their grain food in deep litter. Without exercise the birds are liable to become overfat, a condition which is all against the production of vigorous progeny.

The sire is more than half the flock, and if he is to have the desired prepotency—the power to transmit his inherent quality to his offspring—he must also be maintained in the best condition it is possible to have him in; not necessarily in an overfat condition, but full of life and vigour. The male should be frequently examined, and if it is found that he is becoming run down, or his health is impaired in any way, he should be immediately replaced by a reserve male. Some people depend on one male for the breeding-pen because of the cost of keeping a second bird. This is a mistake. It is much sounder policy to cull a drone hen than a cockerel which would make a desirable reserve sire.

FARM POULTRY.

There are many farmers who still declare that fowls will do little more than pay for the food they eat. Unfortunately, this is very true of the majority of farm flocks in the Dominion. They eat too much for the eggs they lay. If all hens in farm flocks were bred from high-tested strains, and if they were properly housed, fed, and managed, and were rigidly culled at, say, the end of their second laying season, instead of being, as is too often the case, old-age pensioners, our farmers would soon discover that the food consumed by their fowls represented money well expended, and that their poultry were as profitable for the time spent on them as their other stock.

Some farmers base the profits to be made on the class of bird that was available about thirty years ago, when the breeding and management of useful poultry were little studied, and when the great bulk of the fowls were of the barnyard type. It is true that many farmers purchase good foundation stock, but too often these are bred from in a haphazard way. If the good qualities are to be maintained it is of the first importance that only the best specimens be selected year after year for the breeding-pen. The common weakness of using eggs for hatching purposes from the whole of the flock just because they *happen* to be there will soon lead to deterioration, however well the flock may have been bred in the past.

Just as the dairy-farmer endeavours to select his cows on the amount of butterfat they produce, so should the selection be made in the case of fowls according to the number of eggs they lay. The only safe course is to select a few of the best hens and place them in a pen by themselves. Such birds are easily detected by a little study and observation during the late autumn. It will usually be found at this period that the early moulters are the poor layers, and the late moulters the good layers.

It is a mistake for the farmer to keep too many breeds of poultry. One pure breed of fowls and ducks is the most that can be handled to the best advantage. There is no best breed of fowls for the farmer to keep. It is a matter of strain rather than breed that must be always considered. There is often more difference in strains of the same breed, so far as egg-production is concerned, than there is between different breeds. At the present time the White Leghorn is the most popular breed, but it cannot be regarded as an ideal farmer's fowl, chiefly because it is not to be depended upon for hatching and rearing purposes. The value of White Leghorns as egg-layers has been demonstrated by the competitions; but it must be remembered that some of the heavy breeds have done equally well. Taking the year's return for eggs and carcase combined, a good laying-strain of such a breed as the Black Orpington or White Plymouth Rock has several advantages over the light breeds. The chief advantage is that they can be depended upon to make good sitters and mothers, because usually the hatching and rearing of stock on the farm are done in a natural way.

Another bird that presents special advantages to the farmer is the Indian Runner duck. It is a great forager, and when a good range is available it will pick up for its living a considerable amount of material which would otherwise be wasted. Given a good laying-strain of this

breed, they will prove phenomenal egg-producers; in fact, there is nothing better from this standpoint. For table purposes, owing to their general lack of size, they are not favoured, especially for the high-class trade. If, however, a Pekin drake is mated to the Indian Runner females this union will produce an excellent table carcase.

The great weakness on most farms is that few eggs are produced except during the spring and summer months, when the hens lay naturally. If the most profit is to be made, sufficient pullets must be reared each season to replace a proportion of the adult stock. These must be hatched at the right season—say, from July to September—and then, by careful feeding and management, be induced to lay during the late autumn and winter months.

I would appeal to the farmer and his wife to encourage their children to interest themselves in the keeping of poultry. Among farmers' families there is usually a boy or a girl who could undertake the work and take an interest in poultry if given the encouragement and opportunity to do so. This can be best done by purchasing a pen of purebred fowls of a high-type laying-strain, and by providing up-to-date housing and runs. Then the young people should be encouraged to read and study the writings of up-to-date practical men, so that old-time methods of management may be discarded and the most modern ideas adopted. In this connection I would advise securing the Department's pamphlet "Utility-poultry Keeping," which is obtainable at 1s., postage paid, and contains practical advice on all branches connected with the industry. Further, should difficulties arise at any time which cannot be overcome, the advice of the Department's district Poultry Instructor (which service is available gratis) should be sought, in order that the trouble may be investigated and prevented during the early stages.

There are great possibilities for side-line poultry-keeping in the Dominion. On the local market there is no keener demand for any article of diet than for fresh eggs and high-quality table poultry. New Zealand eggs also possess a specially good name on the London market, to which any surplus supply can be exported at payable prices to the producer. The great aim of all poultry-producers should be to develop this trade. It is the farmer in particular who can do this, if he could but be induced to keep nothing but purebred tested stock and give them the same care and attention as his other classes of live-stock. It should be remembered that what is being done at egg-laying tests in high yields can be done at home, or even better.

—*F. C. Brown, Chief Poultry Instructor.*

HORTICULTURE.

CARE OF TOOLS AND IMPLEMENTS.

To speak of the care of implements on the farm is sometimes regarded as a counsel of perfection in these days, and one thinks of methodical people so immersed in detail that the main issues of business are overlooked. While such habits are fatal to the fullest success, those who allow tools to become muddied and rusty and knives blunt and dirty are in a worse plight, and, unfortunately, it is very much the

commoner one. The excuse always is that there is no time to attend to these matters, but one cannot help but feel there is also no desire. To employ a man and give him a blunt, dirty spade to work with is spoiling both the job and the man, with a consequent loss to the employer. If at the end of the day the spade is wiped clean and dry, and put in its allotted place in the shed, it becomes polished, and if sharpened with a file as required an employee will do better work and with more interest; so also with other machinery and implements. The present interval between seasons affords a suitable opportunity to overhaul the implement-shed.

THE GARDEN DIARY.

Risking again the above impeachment, a plea is here made for the garden diary. A record kept—quite apart from the ordinary account-books — of the various operations carried out and their results is invaluable in a business of this kind that is of any size. The book might be spaced off under headings indicating fields or plots or glass-houses, and all details of operations, such as cultivation, manuring, seeding, spraying, harvesting, &c., entered up under the respective titles as they took place. As a frontispiece a plan of the property showing subdivisions and drains would be appropriate.

The value of such a record when planning for another season is obvious, as it enables a true rotation of cropping to be made and manuring recipes to be made out with the greatest chance of economy and effect, in addition to supplying valuable data enabling a correct judgment of the policy that has been adopted in the past. Expensive manures have now to be ordered and crop rotations decided. Right decisions on these points do not depend merely on the operations of the previous season, but of many.

VEGETABLE-GROWING.

Crops of peas, lettuce, cabbage, and cauliflower planted out in late autumn will commence to renew their growth now in the warmer localities. This will require advantage to be taken of the first opportunity in bright dry weather to hoe these crops. Later they may be assisted with a moderate dressing of nitrates. At such a time main-crop cauliflower and cabbage (green and red) and lettuce and onion plants sown in autumn may be planted out on well-prepared ground. A moderate dressing of superphosphate and potash applied just before this is done would be appropriate. For the onion crop the land must be well settled and rolled before planting.

In order to cater for the demand on the farm for the popular pickled onion, a bed of shallots planted now will assure those supplies with very little trouble In a similar manner may garlic also be planted now. Its exceptional medicinal properties and its importance for flavouring dishes, when used with discretion, make this vegetable deserving of more consideration.

Tuber sets of that excellent member of the sunflower family, the Jerusalem artichoke, planted now about 6 in. deep and 2 ft. apart, will, with little further attention, yield an abundant crop of wholesome tubers for winter use. In localities not subject to late frosts a setting of early potatoes may be made, and in the drier districts where it is

the practice to sow the main onion crop in spring that work may be done as soon as the ground can be got into suitable condition. Spinach is a popular dish in spring and early summer. It also may be sown now to advantage, also lettuce.

The asparagus and rhubarb beds will soon require attention. Give them shallow cultivation, turning in a good dressing of organic manures —blood and bone-meal if others are not available.

Pricking out seedling tomato-plants into boxes and preparing the ground in the glasshouses where they are later to be planted out is seasonable work for this section. Avoid chilling the young plants by watering them with very cold water. It is a good plan to stand tins of water in the glasshouse some time before it is required, so that its temperature may be raised sufficiently.

THE SMALL-FRUITS SECTION.

Pruning in the small-fruits section is an operation demanding attention at the present moment. While tomatoes and vegetable crops are commonly very heavily manured, it is rather surprising that these heavy-bearing berry plants are so often in poor condition for want of manure. The present is a suitable time to give this attention, turning the manure in with a shallow ploughing.

If these operations are carried out in a liberal manner the natural vigour of the plants will go a long way in resisting most ordinary diseases. It is as well, however, to give most plantings at this season a good application—just as growth commences—of that bluestone spray known as Bordeaux mixture, using the formula 8–6–40 when mixing—that is, 8 lb. bluestone, 6 lb. lime, and 40 gallons water. The correct method of mixing this spray is important. Other methods of mixing the same ingredients give quite a different and inferior result. Departmental bulletins on these sprays may be obtained free of cost on application.

PLANTING OF TREES AND SHRUBS.

The planting of trees and shrubs should be proceeded with as weather permits. Plants must not be left about with their roots exposed. Those left over at the end of the day should be carefully heeled in until time permits them to be placed in a permanent position.

PREPARATIONS FOR NEXT SEASON'S TOBACCO CROP.

The tobacco crops of the past season were good where the planting-out was done early—at the beginning of November. The spring rains gave the plants a good start, while the ensuing early harvest in February or thereabouts afforded best conditions for curing. Planters who were unable to get their plants out till December missed the rains, and those crops were correspondingly short in weight. The constant recurrence of this experience makes it advisable to make every effort to adopt the former method. To do this the plants must be grown early, and that is the difficulty for many.

As the sowing should be made during the month of August the preparations may be commenced now. First obtain seed suitable for the purpose in view. As with other plants, there are a number of varieties—some unsuitable to one's climate and soil, others unsuitable

for the purpose in view. Some localities have made progress in this search for the most suitable variety for their conditions and purpose. New districts must plant experimentally for some time yet. This question of variety and strain of tobacco-seed is of first importance in attaining a high-quality product.

Owing to the uncertain germination of many samples of tobacco-seed it is very desirable, in order to avoid disappointment, to make tests before sowing. This may be done by counting out a hundred seeds, placing them between wet blotting-paper or flannel, and keeping them at a temperature of about 80° F. In a week or ten days germination of the sound seed will take place. Keep the sample moist as well as warm. An ounce of good seed should grow sufficient plants for 5 acres of crop.

Where hedge-trimmings are heaped and burnt the corn grows strong and of a good colour. There is an absence of weeds, and over the whole area of the burn the condition of the crop is so superior that it is readily seen even at a distance. The tobacco-grower should take advantage of this experience when preparing his seed-beds, by heaping such trimmings over the land where the tobacco-seed is to be sown and burning them. Among other effects, this operation sterilizes the surface soil, destroys weed-seeds, and leaves a fine deposit of potash and charcoal. The remains of the larger sticks are then raked off and the ground cultivated to a depth of about 3 in. or 4 in. At this operation a dressing of 2 lb. superphosphate and 1 lb. nitrate of soda per 10 square yards may be made and turned in. It is indispensable that the locality for this purpose should be generally warm, sheltered, and well drained. A plot 1 yard by 10 yards will grow sufficient plants for an acre, but to provide against accident it is advisable to make ample provision by laying down extra plots a little after the first sowing.

It is also necessary now to give some consideration to the land on which it is proposed to grow the tobacco crop, especially if it is now down in grass. To thoroughly clean the land before planting is important, as the less the leaves are interfered with after the tobacco is planted the better they will be. Quantities of large leaves of heavy body may be grown on strong land, but a leaf that will come out of the cure with a bright attractive colour and the requisite aroma can best be grown on a friable soil of medium quality.

—*W. C. Hyde, Horticulturist.*

WHEAT AND OATS THRESHINGS.

RETURNS of actual threshings up to 19th May received by the Government Statistician from threshing-mill owners showed that until then totals of 3,462,618 bushels of wheat and 2,410,932 bushels of oats had been threshed out. The average yield per acre in cases where particulars of areas were furnished (covering 99 per cent. of total threshings) worked out at 31·36 bushels for wheat and 40·22 bushels for oats. The figures for the Canterbury, Otago, and Southland Land Districts respectively were as follows: Canterbury—Wheat, 2,718,466 bushels threshed, averaging 30·15 bushels; oats, 1,050,351 bushels threshed, averaging 34·99 bushels. Otago—Wheat, 597,061 bushels, averaging 40·10 bushels; oats, 911,737 bushels, averaging 45·86 bushels. Southland—Wheat, 16,831 bushels, averaging 34·28 bushels; oats, 381,979 bushels, averaging 49·60 bushels per acre.

WEATHER RECORDS: MAY, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE month of May was remarkable for the changeability of the weather. Barometric pressure had the high range of over 1¾ in. in the South, and great fluctuations occurred over the whole Dominion.

There were three anticyclonic periods, culminating on the 7th, 17th, and 31st; but between these areas of high pressure were several disturbances associated with stormy conditions. An extensive westerly depression ruled over the Dominion between the 2nd and 6th. The gradient was more severe in the North than in the South, and gales, with heavy rain, were reported, especially in and north of Cook Strait. A sudden and steep fall in the barometer on the 9th accounted for boisterous conditions and a deluge on the West Coast; pressure then continued low and the weather unsettled for a week.

An ex-tropical disturbance made its appearance to the north of New Zealand on the 17th, and, travelling slowly south, the centre apparently passed about Cook Strait on the 23rd. This, united with an Antarctic "low," resulted in nearly a fortnight of bad weather.

Rainfall was much above the average in almost all parts of the Dominion, but, considering the turbulence of the atmosphere, and partly in consequence, temperatures were comparatively mild. There were a few sharp frosts, but a good autumn growth of grass was reported.

RAINFALL FOR MAY, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	8·74	18	1·80	5·06
Russell	10·56	21	2·42	3·53
Whangarei	11·51	19	3·88	6·59
Auckland	13·70	22	3·40	4·50
Hamilton	10·69	24	1·55	4·41
Kawhia	10·14	22	1·86	4·77
New Plymouth	10·13	24	2·50	6·15
Riversdale, Inglewood	19·71	25	2·86	9·82
Whangamomona	14·44	21	3·00	6·59
Tairua, Thames	12·62	17	4·20	6·11
Tauranga	8·98	19	1·20	5·16
Maraehako Station, Opotiki	4·86	18	0·78	4·82
Gisborne	4·76	13	1·54	5·67
Taupo	8·33	16	1·66	3·60
Napier	3·18	14	1·26	3·74
Maraekakaho Station, Hastings	4·48	15	1·62	3·52
Taihape	6·08	24	1·44	3·84
Masterton	6·28	22	1·13	4·03
Patea	6·44	22	1·15	3·91
Wanganui	6·42	18	1·25	3·40
Foxton	5·09	15	0·70	2·32
Wellington	4·77	20	1·08	4·76
South Island.				
Westport	7·34	21	1·51	6·58
Greymouth	11·78	20	2·15	8·39
Hokitika	15·05	21	2·96	9·71
Ross	16·27	20	2·58	9·73
Arthur's Pass	34·31	15	5·50	10·9

RAINFALL FOR MAY, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Okuru, Westland	13·14	16	1·85	11·60
Collingwood	15·85	26	2·08	10·18
Nelson	5·38	18	1·23	3·08
Spring Creek, Blenheim	5·59	14	1·45	2·49
Tophouse	10·96	17	2·21	5·46
Hanmer Springs	5·44	18	0·57	4·47
Highfield, Waiau	3·02	16	0·54	2·76
Gore Bay	1·63	8	0·43	3·43
Christchurch	3·14	20	1·13	2·65
Timaru	3·18	15	1·01	1·41
Lambrook Station, Fairlie	4·18	8	1·10	1·28
Benmore Station, Clearburn	4·30	15	1·10	1·75
Oamaru	4·19	13	1·53	1·61
Queenstown	3·18	11	1·13	2·71
Clyde	3·12	11	1·06	0·97
Dunedin	5·30	24	1·24	3·23
Wendon	2·99	13	0·77	2·31
Gore	3·73	23	0·70	2·71
Invercargill	5·56	26	0·68	4·46
Puysegur Point	8·18	25	1·18	6·81

—*D. C. Bates, Director.*

BOOKS RECEIVED.

"MANUAL OF DAIRY SCIENCE," by A. H. R. Amess (Director, Stratford Technical High School) and H. C. Johnson (Agricultural Science Master, Stratford Technical High School). New Zealand Practical Handbooks Series, Whitcombe and Tombs, Wellington, &c., 4s. 6d.

"FARM MEASUREMENTS: A PRACTICAL TREATMENT OF PROBLEMS IN MENSURATION," by A. G. Ruston (Lecturer in Agricultural Economics, University of Leeds) and C. V. Dawe (Assistant Lecturer). University Tutorial Press, London, 2s. 6d.

"FARM CALCULATIONS AND ACCOUNTS," by A. G. Ruston and C. V. Dawe. University Tutorial Press, London, 3s. 6d.

EGGS AND EGG-PULP IN COLD STORAGE.

A RETURN issued by the Government Statistician shows the following stocks in the Dominion as at 31st March, 1926—corresponding figures for the same date in 1925 being added in parentheses: Eggs in shell, 34,962 dozen (59,698 dozen); egg-pulp, 912,476 lb. (584,601 lb.); frozen whites, 556 lb. (1,773 lb.); frozen yolks, nil (nil).

FORTHCOMING WINTER SHOWS.

Wanganui A. and P. Association: Wanganui, 24th to 26th June.
Rotorua A. and P. Association: Rotorua, 30th June.
South Taranaki Winter Show Company: Hawera, 30th June to 7th July.
Poverty Bay A. and P. Association: Gisborne, 1st and 2nd July.
Wellington Show Association: Wellington, 10th to 24th July.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT FOR INTERNAL PARASITES IN LAMBS.

"LAMBS," Taumarunui :—

Do you recommend either of the following remedies for lung-worm in lambs: (1) $\frac{1}{8}$ oz. asafœtida, $\frac{1}{8}$ oz. turpentine, and $\frac{3}{8}$ oz. linseed-oil, given in half a gill of milk two days consecutively on an empty stomach; (2) inject into windpipe with hypodermic syringe 10 minims carbolic oil, 15 minims chloroform, and 30 minims turpentine? If not, I should be glad to have your advice for both prevention and cure.

The Live-stock Division :—

We do not recommend the intra-tracheal injection of drugs for the prevention or cure of lung-worm in lambs. The prescription of asafœtida, turpentine, and linseed-oil would probably not have very much effect on worms living in the lungs, but it might benefit the lamb on account of its action on the stomach-worm, which is usually coexistent with the parasite in the lung, and which is known to cause the greater amount of trouble. Prevention of this parasitic infestation is best achieved by keeping the lambs on dry and well-drained land on which water does not lie, and where there are no swamps or stagnant pools. A most important step in the management of this affection lies in allowing the lambs a daily ration of good easily digested food, such as crushed oats, chaff, or good hay, for without keeping up the strength of the animal by nutritious food medicines are of little use. Medicinal treatment for the alleviation of the attacks on the stomach by the stomach-worm, as advised by this Division, is the administration of a drench of lysol in milk as follows: For lambs over six months old, $\frac{1}{2}$ teaspoonful lysol; for hoggets, $\frac{3}{4}$ teaspoonful; for two-tooths, 1 teaspoonful—given in one-third pint of milk daily for four days. Then allow a rest of eight days, and repeat the dose if necessary. Great care must be exercised in order that none of the drench shall get into the windpipe; and for that purpose the nose of the lamb should not be forced up into a vertical position with the object of hurrying on the process. An alternative drench is made by dissolving 2 oz. bluestone in 1 gallon water, the dose for lambs being two medium tablespoonfuls, and for hoggets four medium tablespoonfuls—to be given after fasting overnight.

RESTORATION OF GRASSLAND REVERTING TO FERN.

H. J., Te Awamutu :—

Three years ago I burnt and disked a piece of fair to medium ridge covered with fern and light manuka, and sowed it down with a mixture of English grasses and danthonia, but since then have done nothing further to it. There is still a fair amount of cocksfoot, dogstail, &c., but it is stunted, and the fern is gradually taking possession again. I thought of top-dressing it with super and Nauru phosphate, and mixing in the manure some brown-top, paspalum, and subterranean clover, and tripoding it well. What quantity of seed would you advise per acre?

The Fields Division :—

As your land is light, medium-class country, the application of superphosphate now at 2 cwt. to 3 cwt. per acre would probably be most suitable. When such country is commencing to deteriorate it is better to use a liberal dressing at the commencement. If it is safe to use the mover over it there should be no difficulty in bringing this paddock back to profit. Mow the paddock during September, just when the new fronds are appearing, and rake into windrows and burn. Then give the paddock a thorough harrowing with good stiff tripod harrows.

This will tear out bracken and piripiri and generally open up the old pasture. The conditions would then be right for sowing a light mixture of grasses and clovers. This should be mixed with, say, 1 cwt. super, and should include the following per acre: Paspalum, 8 lb.; brown-top, 1 lb.; subterranean clover, ½ lb.; white clover, 1 lb.; cow-grass, 1 lb. After the first stocking the tripod should again be used, and if periodically run over the paddock when the fern commences to make growth it will eventually be controlled. The feeding-out of crops or hay on the field will greatly assist in crushing the fern, and the resulting treading by stock and scattering of dung will do much to encourage a close sward.

NITROGENOUS TOP-DRESSING FOR PASTURE.

"FERTILIZER," Rangiora :—

I have noticed that where cattle, &c., urinate on the grass the growth soon becomes very dark green and luxuriant, and it is these patches that are fed down first. I propose to top-dress a paddock with super, and would be glad to know what artificial fertilizer I can add to the super to produce this dark-green rapid growth, and whether you think it a good proposition.

The Fields Division :—

The dark colour which appears in grass on which stock have urinated is no doubt due to the nitrogen compounds present. The best artificial substitute would be nitrate of soda or sulphate of ammonia. On silty or light soils the former may be tried, and on heavy clay lands the ammonia compound should be used. These dressings should not be applied with the super, except perhaps in small quantity, but should be made as a top-dressing soon after the grass freshens in the spring, at the rate of about 1 cwt. per acre. Experimental evidence to date in Canterbury is in favour of 2 cwt. of super applied during the winter months.

SHEEP WITH OPHTHALMIA.

O. W. GREEN, Marton :—

Going through the hoggets the other day I noticed some with running eyes. On examination I found the eyelid inflamed and the ball of the eye turning a whitish colour; one or two of the animals were quite blind. They are in good condition otherwise. Can you please advise me on the matter?

The Live-stock Division :—

The condition affecting the eyes of your sheep is known as ophthalmia. It appears annually in various districts, but rarely assumes epidemic form. Treatment consists in separating all affected animals from the rest of the flock, placing them in a safe paddock, bathing the eyes with boracic acid in water, and changing the feed.

KEROSENE-LAMPS FOR HEATING GLASSHOUSES.

"Beginner," Wanganui :—

Regarding the heating of glasshouses with kerosene-lamps, would the smoke or fumes be harmful to plants, and would it be advisable to use a shaded light or a bright one? What would be a safe temperature to maintain on a frosty night for tomatoes?

The Horticulture Division :—

Well-trimmed kerosene-lamps would be handy in a glasshouse in a cold snap, and whether they were shaded or not would probably make little difference. What would be a safe temperature would depend on how the plants had been grown; strong tomato-plants in fairly dry condition should not suffer if kept above 40°–45° F. While useful in an emergency, it is doubtful whether these lamps would be a satisfactory and economical method for general heating purposes.

New Zealand Department of Agriculture.

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THE IMPORTANCE OF TEXTURE IN SOILS.

LOOSE AND CLOSE SOILS COMPARED.

B. C. ASTON, F.N.Z.Inst., Chemist to the Department of Agriculture.

SPEAKING generally, the two great factors which between them determine the fertility of soils are climate and the texture of the soil. Texture is a convenient term to denote the relative fineness of the particles which make up the soil.

Climate determines the amount of water which falls on the soil, and texture is responsible for the length of time such water is retained. The texture may be either too loose or too close. An example of a loose type are the coastal dune sands, containing some 95 per cent. of sand, where water does not lie. An example of a close type is a soil which contains such an excess of clay particles that it can be worked only when at a certain optimum content of water, and which is liable to puddle in wet weather and to parch and crack in droughty seasons. In between these two extremes lie the great majority of fertile soils, containing such a proportion of fine and coarse particles and clay that each kind contributes something of its quality to the resultant mixture and mitigates the effect of any one group of particles.

The results were published in last month's *Journal* of mechanical analyses of Rotorua County soils. The present article serves to throw some further light on these.

The mineral particles comprising a soil are separable into three classes—sands, silts, and clay. The distinction between them in the case of sands and silts is not so clear as between these and the clay particles. What is meant by "sand" hardly requires explanation. The example given of the dune sands is a very good one. Silts are really finely ground sands, but the finer grade of silt possesses some of the characters of clays in the tendency to cake together and also to block up the interstices of the soil. Clay particles, on the other hand, are somewhat sharply separated from the other mineral particles. There is no grittiness in their texture. When dry they expand with water, and on drying they contract. If the drying is pushed further and a red heat applied the nature of the clay is completely changed

and cannot be restored by rewetting. It is the proportions of sand, silt, and clay that determine whether a soil is termed light or heavy, dry or wet, easy or difficult to work, and whether it responds best to quicklime or carbonate of lime or to organic manuring; also, the climate being unchanged, whether crops grown are early or late.

A few lines may be devoted to a description of these three kinds of soil particles, which are further subdivided in the case of sands and silts into fine and coarse fractions.

Clay is perhaps the most important mineral constituent of the soil in its influence on soil-fertility. It is what is called a plastic colloid, but it exhibits its properties only if an amount of water is present. When rubbed with water it puddles and makes a substance impervious to water or air. It is smallest of all the soil particles, and has the effect of binding the soil together and of increasing the water-holding capacity.

If only a little clay is present the soil has so little power of retaining water that the plant is dependent on a regular rainfall or on an underground supply of water near the surface. This is what happens in most places in Rotorua County. The soil contains so little clay that the water quickly runs through it. Were it not for the high and well-distributed rainfall, or the closeness of the water-table in the area adjoining the Lake, all the ills which follow a droughty condition of the soil would result. In the absence of a favourable water-supply, sandy soils in the south part of England containing less than 4 per cent. of clay are barren and uncultivated, and it is not until the amount of clay reaches 10 to 14 per cent. that satisfactory results are obtained.

Larger amounts of clay have too great a binding effect and must be counteracted by coarse sand, stable or other organic manure, or by liming. With too much clay—say, 40 to 50 per cent.—the land becomes so tenacious that under English climatic conditions it is abandoned to pasture. Clay is the substance which contributes the gelatinous effect to soils, and when shaken with pure water the clay particles are so constituted that they may remain suspended for months.

Clay makes a soil more difficult to till, but limestone or quicklime —either of which is converted ultimately into bicarbonate of lime in the soil—corrects the ill effects of the clay by flocculating it—that is, causing the minute particles to separate into flocks.

The presence of the optimum amount of clay in a soil is useful not only in hindering the leaching away of those plant-foods which are liable to be so lost, but clay particles actually combine with or "fix" the ammonia and potash of the salts of these bases when applied as manure—a very valuable function.

The silt fractions have some of the properties of clay in increasing the water-holding capacity of the soil and making it more difficult to work, especially if much clay is also present. Silt particles, however, quickly subside when agitated with water. Silts differ from clays in the fact that where their proportion is ill balanced and the land is intractable they cannot, under English conditions, according to Hall and Russell, be ameliorated by lime treatment. In New Zealand very great areas of silts are found in the South Island, both in the Westland and the Otago Central districts—the mica-schist silts. These do

respond to liming, but it is not plain whether this is due to chemical or to mechanical improvement. Some silty soils cake together tenaceously after rain on the surface, and their treatment presents special problems which do not confront the tiller of the more common types of soil. It will be seen that in the Rotorua County soils the silts are present in amounts greater than the clay fraction—an unusual combination. The presence of such an amount of silt is probably highly beneficial in the absence of clay, which is present only in amount of the order of 1 or 2 per cent.

Fine sand is present in all, and forms a considerable proportion of most soils. It has not so great an effect as silt in maintaining a good moist condition; caking of the surface takes place sometimes with fine sands as with silts. Some fine sands, owing to excessive porosity, are notoriously infertile when much fine sand is present and clay lacking.

Coarse sand is said to be the most variable mineral fraction of the soil. It is in its action the reverse of clay, and therefore exercises a great effect in the general fertility, keeping the soil open and friable, facilitating tillage, and increasing drainage and evaporation. For English climatic conditions it has been laid down that a soil containing 40 per cent. or more of coarse sand and less than 5 per cent. of clay is tillable only where large quantities of dung are available or where the water-supply is exceptionally good. As the supply of coarse sand increases, one arrives finally at the conditions presented by the dune sands, characterized by extreme mobility and deficient water-holding capacity, therefore liability to drought and to undue leaching away of any nitrogenous manure or lime applied. Such sands can be improved only by claying, or by green-manuring or its equivalent—that is, some method of increasing the organic matter present.

It will be seen in the analyses published that many of the Rotorua soils contain more than 40 per cent. of coarse sand, but the sand is of the porous pumiceous character, and the rainfall of the district much greater and better distributed than that of many temperate countries. Moreover, the chemical composition of the particles is entirely different from that of the sands common in England. Hence there are three good reasons why no unduly pessimistic view should be taken of the pumice soils in question. Further, the sandy particles will in time, with tillage and the resulting compaction and the incorporation of organic matter, decompose into a substance tending towards that clay which would be the salvation of all these lands were it economically possible to apply it.

A SOIL-DETERMINATION CHART.

By the aid of the accompanying chart (which is adapted from a paper by A. Nostitz, Munich) it is possible to obtain a diagrammatic view of the probable fertility of a soil when judged by its mechanical composition, after first calculating the mineral constituents of the soil in percentages—that is, after eliminating all water and organic matter. Where the humus or organic matter of the soil is not present in sufficient proportion to influence greatly the net effect of all the mineral particles the diagram may prove useful in assisting one to come to a decision as to a soil's probable fertility. Where sufficient organic

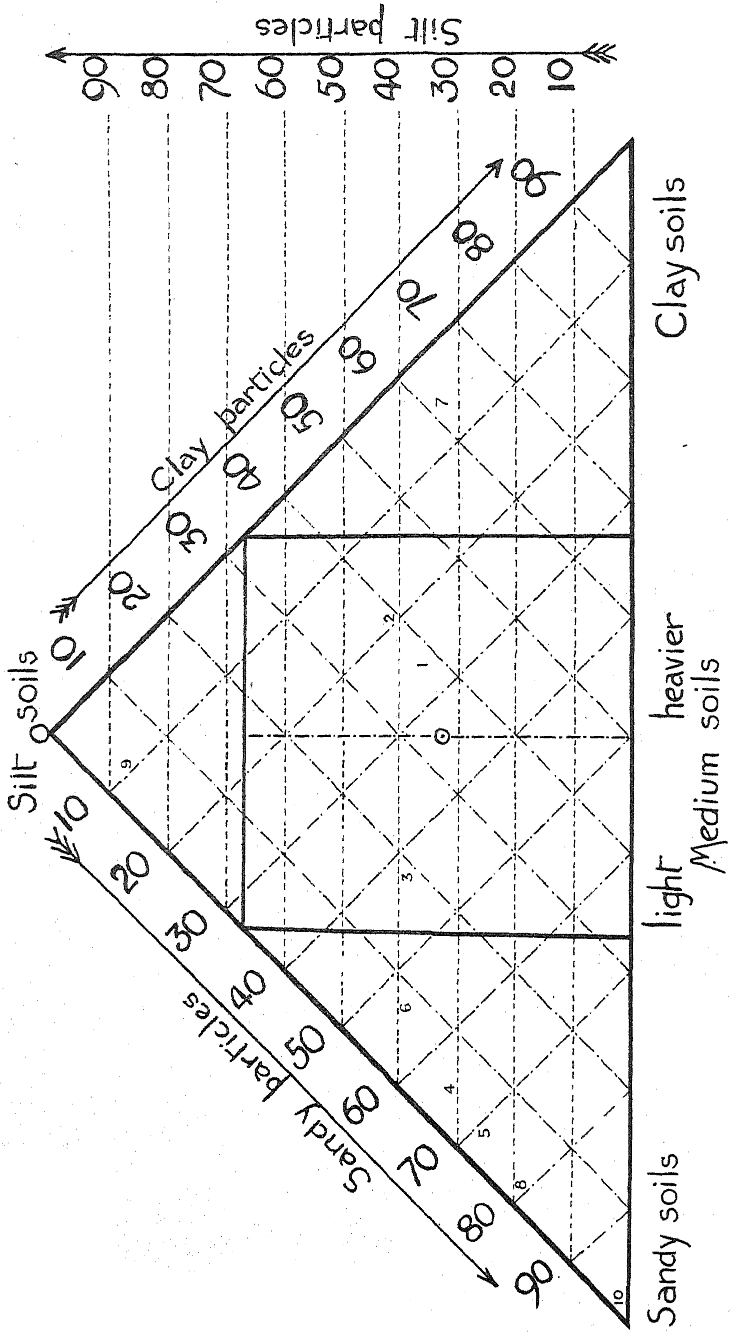

CHART EXPLAINING INFLUENCE OF DIFFERENTLY SIZED SOIL PARTICLES IN FORMING AVERAGE FERTILE SOILS.

For key to soils represented by small figures see opposite page.

matter is present it obliterates all distinctions conferred by the mineral portions of the soil.

By following the lines of the triangle one may pick out the position of any soil the composition of which is given. In the centre of the triangle is a square figure within which all normal soils should fall. Divided by a vertical line, the square figure shows on the left side the lighter and on the right side the heavier soils. As one approaches the vertical line the nearer one gets to physical perfection; as one recedes from it the nearer one approaches sterility, due on the one side to lack of water-holding power and on the other to excessive water-holding power of the soil. At either end of the base line of the triangle one arrives at soils barren from properties which are opposite in their cause. Thus at the extreme left one finds a soil with 100 per cent. of sand, which should be barren owing to porosity, excessive aeration, mobility, and lack of water-holding power—therefore droughty, allowing water to run away rapidly, carrying nitrogenous plant-food and lime, and impossible of cultivation owing to the ease with which wind will transport the particles. At the other end of the line is a soil with 100 per cent. of clay, which would give conditions conducive to sterility owing to excessive tenacity of the soil and the difficulty of working it or of getting fertilizer incorporated.

The sovereign remedy for excess on the left-hand side (the sands) is organic matter, and on the right-hand side (the clays) is quicklime. What is the cure for excessive silt must be determined by a practical test of either or both of the foregoing, remembering the dictum that organic matter will obliterate all distinctions conferred by mineral matters.

Only a few examples of known New Zealand soils are given as examples in the chart, so as not to make the matter too difficult to follow. The Ngawaro coarse sand, the Te Pu coarse sandy silt, the Mamaku sandy silt, and the Oturoa loam all fall outside the square, but as they approach it they improve in quality, judged by their known fertility. They may therefore be classed as extreme types of soils. Within the square are placed three soils from Te Kauwhata (mid-Waikato), which represent the heavier and lighter medium soils the agricultural value of which is undoubted. On the extreme right of the triangle is placed a clay soil, and in the extreme top a river-silt from Poverty Bay. At the extreme left of the base are placed the dune sands of the Wellington west coast. The three extreme types of mineral soils are thus fully exemplified.

Key to Chart.

Analyses of soils with water and organic matter eliminated.

No.		Sand.	Silt.	Clay.
1.	Clay loam, Te Kauwhata	25	35	40
2.	Clay, Te Kauwhata	20	40	40
3.	Loam, Te Kauwhata	40	40	20
4.	Sandy silt, Mamaku	65	30	5
5.	Coarse sandy silt, Te Pu	70	25	5
6.	Sandy loam, Oturoa	55	40	5
7.	Clay, Samoa	5	30	65
8.	Coarse sand, Ngawaro	78	20	2
9.	Silt, Poverty Bay	18	80	2
10.	Dune sand, Manawatu	100	..	..

FIELD EXPERIMENTAL METHODS.

PRACTICE OF THE FIELDS DIVISION IN CANTERBURY.

A. W. HUDSON, B.Sc., B.Ag., Instructor in Agriculture, Christchurch.

SINCE April, 1925, a number of articles dealing with experiments the results of which have been subjected to statistical examination have been published in this *Journal* under the names of F. E. Ward and the present writer. In each case the method of conducting the work has been described.

With certain crops in the past season considerable modification of the method has been effected, and the object of this article is to describe these methods, which have given excellent results from the point of view of (1) minimizing the work, (2) increasing the degree of precision, (3) reducing the area occupied by an experiment, and (4) greatly diminishing the distances between compared plots.

The work of the preceding year paved the way to improvement by providing a knowledge of probable errors likely to be associated with the plots of varying sizes and dimensions. Further, some idea of the probable differences between treatments which are likely to result has proved extremely helpful in enabling the number of plots required for measurement of such differences to be decided upon.

In planning each experiment full consideration has been given to the following points :—

(1.) Probable differences likely to result between compared treatments, and number of plots required arranged accordingly.

(2.) Arrangement of plots in such a way as to bring compared plots immediately alongside or within a few feet of one another.

(3.) Arrangement of plots to run in the direction of soil variation (if determinable), and across feerings and finishes.

(4.) Correct rate of sowing of manures.

(5.) Uniformity of conditions at time of sowing; when possible, all compared treatments are sown the same day.

CEREAL MANURING EXPERIMENTS.

In order to test the practicability of the use of a small drill for cereal, rape, and turnip manuring, one was borrowed from Lincoln College, and our indebtedness to the Director of that institution is here recorded. The machine proved highly satisfactory, and a similar one was soon procured by this Department. The drill is seen in Fig. 1.

The variation in the rate of running of different fertilizers or mixtures under varying weather conditions is well known to be considerable. Hence, every time a particular fertilizer or mixture is to be sown a preliminary trial to determine the required adjustment is necessary.

Drill Adjustment.

A preliminary trial is carried out by jacking up the wheel of the drill, placing a quantity of the manure to be tried in the box, and turning the wheel through as many rotations as it would make in travelling a distance of 10 chains (Fig. 1). With the drill in use (a seven-coulter machine) 10 chains by one drill-width equalls approximately $\frac{1}{16}$ acre. The material running down the tubes is caught on a sheet and weighed to the nearest $\frac{1}{10}$ lb. with a delicate spring balance. The rate of turning of the wheel does not have any appreciable effect on the amount delivered. Each manure to be used is tried in this way, each being cleaned out as far as possible without removal of the feed-stars after the adjustment is found. It is a noteworthy fact that when a free-running manure

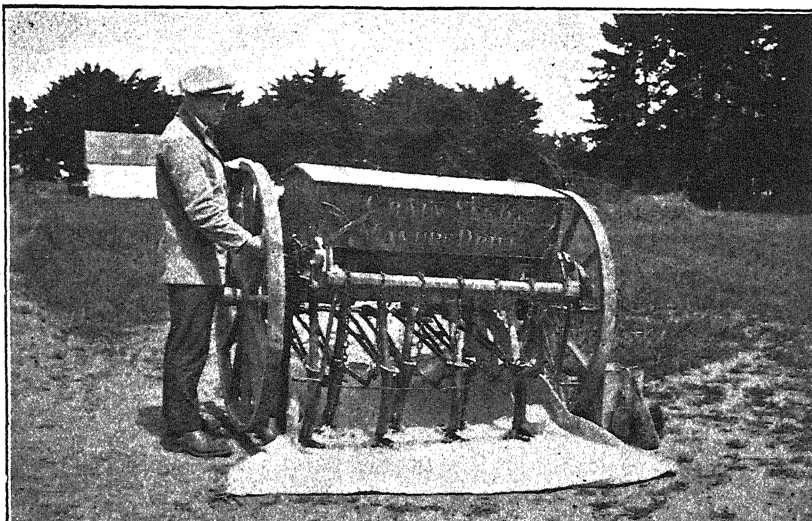

FIG. 1. PRELIMINARY ADJUSTMENT OF DRILL BY JACKING UP AND TURNING WHEEL. [*Photo by F. E. Ward.*

follows one inclined to be "sticky" it will not be delivered at a uniform rate until a distance of about 10 chains or its equivalent in revolutions of the wheel has been traversed. Its rate tends to increase up to a point—apparently until the manure is well run in round the stars. The converse holds when a sticky manure follows a free-running one.

The adjustment obtained as described serves as a good guide for the actual adjustment required in the field. However, before the sowing of plots is carried out a further test of the rate of sowing is made over a measured distance along a headland, or on ground in close proximity to the experimental area. In this case a weighed quantity sufficient to sow the distance traversed, plus enough to keep the stars well covered, is put into the drill—the amount remaining after the trial subtracted from that put into the machine giving the quantity sown.

When experience with mixtures, &c., is gained it is generally possible to procure adjustment with not more than two or three trials. As a further precaution the amount sown in the plots is checked, and does not usually differ from the desired quantity by more than 3 to 5 per cent.

Sowing of Plots.

In order to explain this method it will be assumed that ten replications of treatments are being tried in a particular experiment, and these treatments designated *A*, *b*, *C*, *d*. The drill-coulters are spaced 7 in. apart, and a double space of 14 in. is left between plots; hence the total width of each plot of seven coulters is 4 ft. 8 in.

The treatments are allowed to run in order *A*, *b*, *C*, *d*; *A*, *b*, &c., throughout the experiment. Each plot being 4 ft. 8 in. wide, Plot *A* will fall at intervals of 4 ft. 8 in. by 4, equalling 18 ft. 8 in. To obviate the necessity of frequent cleaning of the manure-box the whole of each treatment is sown before the next is commenced. White-painted sighting-poles about 5 ft. in length, of 1 in. by 1 in. Oregon pine, are placed at intervals of 18 ft. 8 in. along each headland of the experimental area, and where possible a sufficient distance from the "in-and-out" mark (ends of plots) to permit of the turning of the horses without displacing the poles. Intermediate poles are sighted in position, so that with ten replications of a treatment there are ten lines of poles. The driver, sitting in the middle of the drill, keeps himself aligned with the poles while drilling, working up one line and down the next until the whole of the treatment is sown. This operation is shown in Fig. 2. Each line of poles is shifted two plot-widths to one side, and treatment *C* is next drilled in. Blank spaces now alternate with drilled plots. "Filling in" to their allotted spaces now follows with treatments *b* and *d* (Fig. 3).

The object of drilling alternate plots on lines of poles is to ensure uniform spacing. If drilling of Plots *b*, *C*, and *d* followed in order, and a slight and constant error in width of interspace

FIG. 2. SOWING PLOTS ON LINES OF SIGHTING-POLES.

[*Photo by E. M. Bates.*

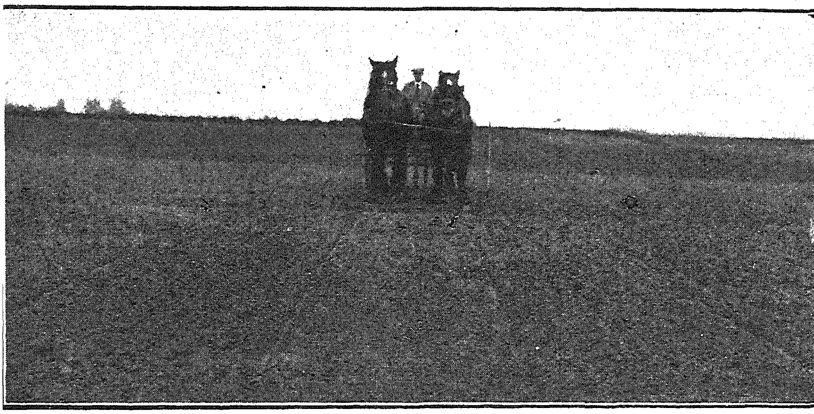

FIG. 3. FILLING-IN OF ALTERNATE PLOTS AFTER OTHERS HAVE BEEN DRILLED ON LINES OF SIGHTING-POLES. [*Photo by E. M. Bates.*

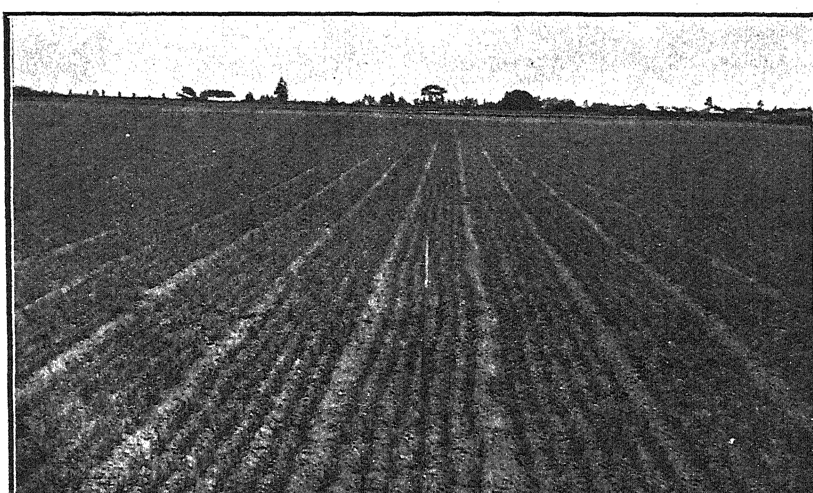

FIG. 4. VIEW OF PART OF TYPICAL CEREAL EXPERIMENT, SHOWING THE UNIFORMITY OF SPACING. [*Photo by A. W. Hudson.*

occurred, by the time the whole were drilled the accumulative error would be considerable, and spacing uneven. Fig. 4 shows the appearance of the growing plots.

Harvesting of Plots.

If ripening of the variously treated plots is fairly uniform harvesting is easy, but if differences in ripening occur some difficulties present themselves, which must be overcome by (1) allowing ripe plots to stand until later-maturing ones are ready to harvest (this entails risk with easily shaken cereal varieties); (2) cutting earlier-maturing plots

by hand; (3) sowing extra plots not required for yield-determination. These latter plots allow for passage of the reaper-and-binder, and a certain amount of rolling down is of no consequence.

A uniformly ripening area would be harvested as follows: The cutting-machine is run across both ends of the plots, leaving all of uniform length. If it is desired to divide each into two by a division midway between the ends a cut of the machine is made in the required position. A return cut follows, and a third in the direction of the first. With an ordinary 6 ft. cut this leaves a space 18 ft. wide.

The plots are now ready for cutting out, and each is taken at one cut of the machine. Starting with the reaper clear of material, it proceeds until the 18 ft. division is reached. By the time this is crossed, and just as the machine is about to enter the next section of the plot being cut, a stop is made, and it will be found that all the material which has been reaped will have been delivered on to the

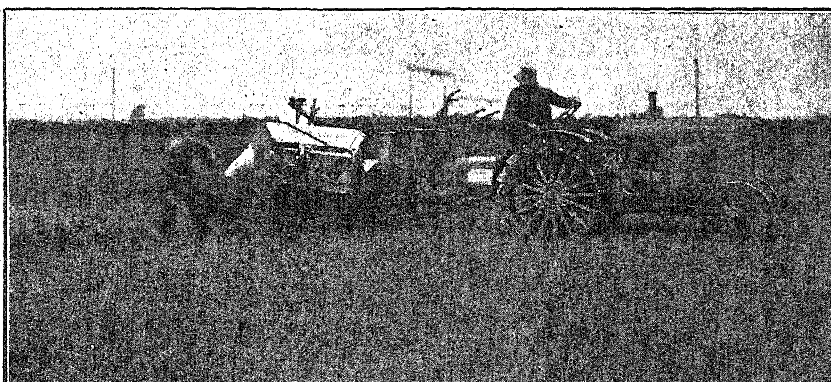

FIG. 5. "RUNNING OUT" THE REAPER-AND-BINDER ON COMPLETION OF A SECTION OF A PLOT AND BEFORE THE CUTTING OF THE NEXT SECTION IS COMMENCED. [*Photo by F. E. Ward.*

Farm of J. Foster, Ladbrook's.

binding-table. The tripper is then pressed down and all the material discharged by rotating the discharge-arms. The cutting of the next section proceeds, and the machine is run some 18 ft. past the end and again cleared.

Without the use of the 18 ft. space, clearing of the machine with the winding-handle is necessary, and this is somewhat laborious. In Fig. 5 a tractor-drawn reaper-and-binder is seen at work, and its use obviates the use of the space required in the case of a horse-drawn machine, owing to the machine being cleared by an independent drive from the tractor.

(It may be mentioned that in the case of variety trials the differences in ripening are considerable, and a specially constructed machine without any side appendages, which would cut its own track, would be ideal.)

Each plot, generally about $\frac{1}{100}$ acre, is labelled and stooked by itself.

Threshing.

This was described in the *Journal* for April, 1925—"Wheat Manurial Tests in Canterbury," Ward and Hudson—to which interested readers are referred.

RAPE AND TURNIP MANURIAL EXPERIMENTS.

The method of drilling manurial trials for rape and turnips is as described for cereals.

Determination of Yields.

Rape: Various methods of cutting have been employed, but none has proved better than that of cutting with a sharp spade. Plots of

FIG. 6. WEIGHING OF RAPE IMMEDIATELY AFTER CUTTING OF PLOT.
[*Photo by A. W. Hudson.*

½ chain by five coulters where sowings are made through every coulter, and by two coulters in the case of 14 in. rows, are cut at ground-level. Thus the outside rows are not taken into account. The cut material is placed in a canvas sheet about 5 ft. 6 in. square and weighed, as shown in Fig. 6, immediately it is cut.

Turnips: Pulling is done by hand or with a light hand-drag, and the turnips weighed in an ordinary grain-sack. Here again outside rows are eliminated, and the length of weighed area is governed by the yield of the heaviest plots. A weight of over 100 lb. becomes difficult to handle, so that a length of plot which will give something a little below this weight is roughly determined before commencing the work on the plots.

Effects of Manures on Germination.

In manurial tests of the preceding year on rape and turnips differences in the number of plants on different treatment were noticeable.

In order to get some idea of this aspect of the manurial treatment germination counts were taken with all cruciferous crops. The method adopted was as follows: A rod 10 ft. in length was taken and dropped indiscriminately on some forty places in the plots of each treatment, the same coulter row being used in every case. The number of plants falling within the 10 ft. length was counted, and the mean and probable error calculated. The counting was done about three weeks to one month after sowing, when all seeds producing plants likely to survive had germinated. Some very valuable and interesting information has resulted, and will be discussed with the publication of results in future issues of the *Journal*.

POTATO MANURIAL EXPERIMENTS.

Up to date only one type of machine has been used for the planting of potatoes with manure. A shallow furrow, in which the manure is deposited, is opened by a moulder in the front of the machine. A second moulder, deepening and dividing the furrow of the first, provides the furrow in which the potatoes are planted. A pair of in-cut disks refill the furrow and cover the potatoes. Thus the manure is slightly mixed with the soil above the seed. Before the sowing of plots a determination of the average width of row is made, and the necessary rate of sowing ascertained by trial over a measured distance. Each treatment consists of six plots, each three rows in width, and the sowing is done in the same manner as that described for the sowing of cereal experiments.

Digging and Sorting.

Digging is done by hand, each plot being divided into a number of ½-chain lengths. A slanting pole is placed at each end of the middle row of each plot. The middle row is dug first, the side rows then being thrown to the middle (Fig. 7). Each plot is bagged separately (Fig. 8),

FIG. 7. METHOD OF MARKING OUT POTATO PLOTS FOR DIGGERS.
The slanting poles are on the middle row and at the end of a plot ½ chain long.
[*Photo by A. W. Hudson.*

FIG 8. POTATOES BAGGED AND BEING LABELLED BEFORE CARTING TO SORTING-MACHINE.

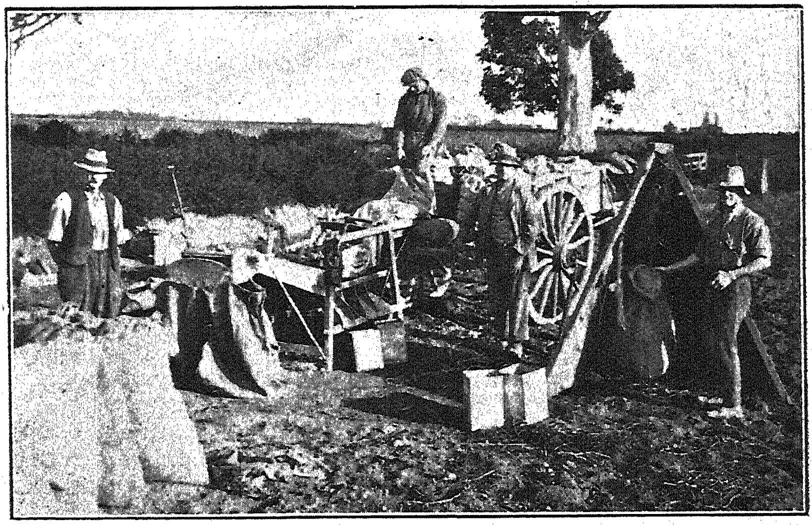

FIG. 9. SORTING AND WEIGHING OF THE VARIOUS GRADES OF POTATOES—TABLE, SEED, AND SMALL. [*Photos by A. W. Hudson.*

Farm of W. and A. Campion, Prebbleton.

and labelled prior to carting to the sorting-machine, where the individual plots are graded into table, seed, and small potatoes (Fig. 9).

PASTURE TOP-DRESSING EXPERIMENTS.

The method described in this *Journal* for June, 1925—"Pasture Top-dressing in Canterbury," Ward and Hudson—has not been altered.

COMPARISON OF YIELDS.

Generally comparisons are made between paired plots, and calculations are by "Student's" method as described by Dr. Hilgendorf in his article, "Student's Method of computing Probable Error in Agricultural Experiments," published in this *Journal* for January, 1925.

The number of plots used in the measurement of differences varies with individual experiments, and is generally dependent on the variation met with and the differences resulting between compared treatments. The published results will contain information relative to this and other points.

DOWNY MILDEW OF THE VINE (*Plasmopara viticola*) IN NEW ZEALAND.

THE DISEASE AND ITS TREATMENT.

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AN outbreak of downy mildew—the first recorded in New Zealand—occurred at Henderson and in the surrounding district during the past season. This disease was first brought to the notice of the Horticulture Division by Mr. H. Corban, of Henderson, who brought in a parcel of vine-foliage to the headquarters for identification of an unknown disease. On opening the parcel I recognized an old and familiar enemy, whose acquaintance was made during my residence in the Bordeaux district of France, where downy mildew was a constant source of alarm during the growing season of the vine. Specimens of the vine-leaves were forwarded to the Department's Mycologist, Mr. G. H. Cunningham, who submitted them to microscopical examination and confirmed the result of my superficial examination.

Acting on official instructions, I visited the Henderson district and, working from that centre, inspected the vineyards and vine nurseries on all sides with a view to ascertaining how far the disease had spread. As a result I came to the conclusion that the field of infection was confined within the limits of a line drawn through Swanson on the north, Manukau Harbour and Auckland City on the south, the upper Waitemata Harbour on the east, and the Tasman Sea on the west.

All the vineyards and nurseries inspected in Henderson, Oratia, New Lynn, and Avondale were more or less infected with downy mildew. Most of these vineyards had been sprayed with bordeaux mixture to control black-spot (which is an annual menace to the vine-growers in this district), and had consequently matured their grape crop without much loss. The disease, however, had made headway where spraying had been discontinued owing to the lateness of the season, the leaves and young shoots showing distinct signs of mildew. In only one vineyard of .3 acres were the effects really disastrous. The grape crop in this case was a complete loss, owing probably to the fact that the proprietor, on noticing the symptoms of downy mildew, ceased spraying

with bordeaux mixture and applied colloidal sulphur, which is useless as a control for the fungus in question.

The outbreak of the disease was observed in most of the vineyards late in December or early in January last, and in all cases was first seen in the lower parts of the vineyards, such as at the bottom of a gully, near a creek, or close to a swampy area. All European varieties grown in the district were affected. Albany Surprise was clean in the vineyard, though affected in the nurseries, but even there I did not notice any that had lost their leaves. The Mouvedre × Rupestris 1202—a popular stock in this district—was affected, and in one nursery the young stocks had lost all their leaves. Incidentally, I believe that this stock could be advantageously replaced as a stock for vines grown on the clay soils of the North by the Riparia × Rupestris 3306, which is more resistant to phylloxera and mildew, and its affinity for the Vinifera scions is quite as good. Moreover, it causes an early and abundant fructification of fine fruit on the grafted varieties. Cuttings and rooted vines of this variety can be obtained on application to the Manager of the Te Kauwhata Horticultural Station, Te Kauwhata.

In view of the certainty of downy mildew recurring each year in which climatic conditions are favourable in the district already infected, and of its very probable spread to other viticultural areas of the Dominion, a description of the outward symptoms and life-history of the disease will no doubt be acceptable to vine-growers to assist them in recognizing it when seen and in applying the most effective means of control at the most appropriate moment.

Downy mildew is the worst fungous disease European vines are subject to, and is remarkable for the rapidity of its spread. From its original home in the United States of America it was unintentionally introduced into France with American vines, and was recorded there in 1878. Three years later it had spread over the viticultural areas of France, Italy, Greece, and north Africa. A more recent example of the rapidity of its distribution is to be found nearer home. A mild attack was noticed in the Rutherglen district of Victoria in 1917, and in the same district in 1918—the weather being favourable for the development of the disease—90 per cent. of the crop was destroyed.

Owing to the enormous losses caused by downy mildew the life-history and means of combating the fungus in the vineyard have been the subject of much study by botanists and viticulturists in most of the vine-growing countries of the world. The following brief summary is compiled from the writings of some of the more recent investigators, principally from those of Messrs. Vialla, Ravaz, Gregory, Capus, Istvanffi, and Verge, who have rendered considerable service to modern viticulturists by the diffusion of the results of their studies of this and other vine diseases.

THE DISEASE AND ITS EFFECTS.

Downy mildew attacks all the young herbaceous part of the vine, principally the leaves and especially the young leaves, the young green shoots, the flowers, and immature grapes. It develops under the influence of heat and humidity—rain, fogs, or dew followed by sunshine or muggy heat.

The effects of the growth of this fungus can result in the loss of entire crops by causing the non-setting of the flowers, by destroying the grapes in the early stages of their growth, or later rendering them unfit for making good wine. The vines may be wholly or partly stripped of their leaves, which is the most frequent result, the result being that the grapes fail to ripen and the fruiting-wood for the following season does not mature for lack of the food supplied by the leaves in normal seasons. The leaves may be attacked at any period of their growth, but become more resistant with age. Wine made from the grapes of mildewed vines is difficult to keep ; it has a disagreeable flavour, and the vinegar-barrel is generally the most suitable place for it.

The visible symptoms are distinct from those of any disease of the vine known in New Zealand. In the early stages light roundish spots are seen on the leaves. Those spots are known as " oil-spots " by the French viticulturist, and this word aptly describes their appearance. From a light-green colour the oil-spots gradually become yellow and finally reddish-brown. They may be isolated or converging, and cover part or the whole of the leaf, in which case the leaf soon perishes and breaks away from its stem.

When humid and warm conditions prevail, efflorescent spots or patches having the appearance of scattered salt develop on the under-side of the leaf and directly under the oil-spots. This " down," from which the name of the disease is taken, can be readily removed by rubbing the finger over it, and the facility with which it is removed distinguishes it from the white spots due to erinose (*Phytopus vitis*), a vine pest which has not yet been reported in New Zealand.

The young green shoots when attacked by downy mildew show spots like those on the leaves, but less easily distinguishable. Later the shoots take on a dark-brown colour and break off with the slightest touch.

In the bunches before or just after the fruit is formed the stalks become black and the flowers or the fruit falls off. If the fungus arrives a little later the berries are covered with a greyish-white down and soon dry up. When larger the berries take on a reddish-brown colour and fail to ripen. The fruit is not safe from the fungus until the berries begin to colour, but the quality of the juice can still be affected by the action of the fungus on the leaves.

LIFE-HISTORY OF PLASMOPARA VITICOLA.

The " down " is only exceptionally seen on the upper surface of the leaves, where it appears alongside the veins. It consists of numerous bush-like growths known in mycology as conidiophores, which are the fructification organs and a continuation of the mycelium or thread-like vegetation of the fungus which develops in the interior of the leaf, where, by means of suckers, it robs the leaf of plant-food and causes the disintegration of the tissue.

The conidiophores grow, in groups of from four to ten, through the stomata or breathing-pores—the majority of which are on the under-side of the vine-leaf—and carry bunches of conidia or summer spores, which when ripe fall on the leaves below or are carried to the herbaceous organs of other vines by the wind. If the conidia happen

to alight in a drop of water, after soaking a while they break up into several segments or zoospores, each of which is furnished with two cilia with which it moves about rapidly in the water. When a stoma or breathing-pore is found it comes to rest and develops a germ-tube, which penetrates by way of the stoma into the interior of the leaf or other organ of the vine. The germination of the conidia under favourable conditions can take place in an hour, and the incubation period within the leaf takes from five to twenty-five days in France, according to the climatic conditions, but generally about seven days, when the oil-spot appears and fructification takes place if sufficient humidity is present in the atmosphere for its development.

It is only during the germination period of the conidia or zoospores that the fungus can be checked. Once the germ has penetrated the tissues of the leaf the incubation and fructification cannot be prevented. It is evident from this that the controlling specific—copper salts, which are easily dissolved by the water on the leaves or other herbaceous parts of the vine—must be there when the spores arrive or immediately after. A very minute quantity suffices to nullify the attack.

Should the germination proceed unchecked another crop of conidia or spores will, under humid conditions, be ready for dispersal in about seven days and so carry on the cycle, which repeats itself under favourable conditions to the end of the season. Dry climatic conditions, or rains followed by drying winds, inhibit the progress of the disease; to continue its life-cycle the fungus cannot dispense with the drop of water.

In case of any doubt as to the nature of oil-spots which do not show any down on their under-surface a simple test may be applied. A few suspected leaves folded in a damp cloth or blotting-paper and placed in a warm atmosphere will, if affected, develop down in about a day's time.

Towards the end of the vegetative season of the vine the usual spots do not appear at the end of the incubation period of the fungus, but in their place a mosaic of different-coloured spots resembling tapestry stitches are seen on the surface of the leaf, and, in the place of the fruiting-organs growing out of the stomata, winter spores or oospores are formed by fusion of the male and female organs in the interior of the leaves. These oospores are protected by a resistant covering which carries them safely through the inclemencies of the winter.

The germination of the oospores from the rotting leaves in the spring depends on their immersion in water in a wet soil or pool, and a temperature of at least 50° F. for a period of not less than twenty-four hours. On this account it is advisable to look out for the first outbreak of the disease in the lower parts of the vineyard near creeks, pools, or other spots where water remains for some time after rain. Gathering the leaves and burning them at the end of the season suggests itself as a method of prevention, but this has not proved effective, nor is it practicable in a large vineyard where the leaves are falling over a long period and get buried or blown into all sorts of corners round the vineyard.

From the germinating winter spore a filament of mycelium or conidiophore grows, terminating in a single conidium resembling the

summer conidium but seven or eight times larger. Inside this conidium are formed a number of small zoospores furnished with cilia, and it is these small spores, or the conidia that contains them, which, when brought into contact with the foliage near the ground, by being splashed or otherwise, cause the first infection.

The area of this first contamination by the winter spores is generally so small that it frequently passes unnoticed. The actual damage done is insignificant; but after the period of incubation in damp weather the efflorescence appears, and summer spores are formed and scattered in countless numbers through the foliage of the vines.

TREATMENT.

During an outbreak of downy mildew in the Gironde, France, in 1882 it was noticed that vines along the roadsides which viticulturists were in the habit of sprinkling with a mixture of sulphate of copper and lime, to prevent pilfering by passers-by, kept their foliage, while the unsprinkled vines lost theirs. This fact induced Millardet and Gayon to study the effects of copper salts, and led to the universal use of the bordeaux mixture as a fungicide to-day. As an indication of the importance of this accidental discovery it is interesting to know that since the works of Millardet and Gayon were published some thirteen hundred authors have written on the subject of copper salts mainly as a fungicide.

It will have become evident to the reader from the foregoing remarks that moisture and heat are essential factors in the germination of the winter and summer spores of downy mildew; that the presence of moisture must coincide with certain phases of the development of the fungus; that winter treatment is useless; and that control can be obtained only by preventive means—the presence of an effective fungicide on the herbaceous part of the vine when the spores arrive there.

To avoid as much as possible the humid conditions which render the progress of the disease possible, vineyards should be planted on well-drained slopes facing the sun, with sufficient protection from the strong gales so prevalent in parts of the Dominion, but sufficiently open to allow the wind to dry the foliage of the vines after rain.

The system of growing the vines on trellis — the most usual method in this country — is a great advantage in the control of fungous diseases, as it permits of a free circulation of air and facilitates the thorough application of fungicides to all parts of the vines. It also makes easier the suppression of excessive development of foliage and growth of weeds between the rows — both forming favourable conditions for the spread of disease, and both exceptionally favoured by the moist climate of some of the viticultural districts in New Zealand. With the aid of the trellis the young growths in the spring can be kept off the ground and to some extent out of reach of the winter spores.

As previously mentioned, the treatment of vines in an infected area to be effective must be of a preventive nature. Owing to the development of the fungus inside the leaf, curative methods are inapplicable.

The fungicide which has received the most universal approval as a control of downy mildew is bordeaux mixture. The strength of the mixture is not of such great importance as the necessity of maintaining a continual supply of the fungicide on the herbaceous parts of the vine, so that the spores arriving in the drop of water find some of the copper salts in solution and are thereby rendered innocuous. Copper salts which remain active during the period of the germination of the spores will control the most severe attack of mildew. Spraying after rain is effective if applied before the germ-tubes have penetrated. Bordeaux which has had time to dry on the foliage resists the washing effects of rain, and releases sufficient copper salt to destroy the spores of the mildew.

While treatments made just before the probable appearance of the disease are of primary importance, the application of bordeaux mixture on the appearance of the characteristic oil-spots—a week after rain followed by a warm temperature—should be proceeded with at once, so as to save the sound foliage. The spray will check the spread of the disease by destroying the fructifications on the under-side of the affected leaves. Young shoots and bunches of flowers and young grapes should be well covered and penetrated with spray. To ensure the adhesion of the spray to the bunches the addition of a spreader is necessary on account of the waxy nature of the surface of these organs. Fresh applications of bordeaux should be made to the newly grown leaves as they appear in seasons favourable to downy mildew while there is still a residue of former treatments on the vines.

In normal seasons applications of bordeaux of 1½-per-cent. strength, or 2 per cent. in humid seasons (6–4–40 or 8–6–40), should be applied —(1) As soon as possible after the buds break; (2) before the flowers open; (3) when the petals have fallen; (4) fourteen days later, or as required, in seasons favourable to the development of the disease, being careful to keep the young growths covered with spray as they grow.

The first two treatments are of capital importance, and should be applied whatever the condition of the weather. In seasons of intense invasions of downy mildew, or where powdery mildew is expected, the second and third sprayings should be followed, while the vines are still wet with the spray or the morning dew, with a powder composed in the proportion of 7 lb. sublimated or precipitated sulphur, 2 lb. air-slaked lime, and ¾ lb. finely powdered sulphate of copper (bluestone). This should be applied with a sulphur-bellows, hand or knapsack, as when sulphuring for powdery mildew. While the whole of the vine should be sulphured, special attention must be given to the sulphuring of the bunches and fresh growths

The remainder of the programme must be modified to suit conditions, keeping in mind that neglect to spray in time may mean the loss of the entire crop of the season, and possibly part of the following season's.

The 1½-per-cent. bordeaux, which will probably be found the most useful in normal seasons (2-per-cent. or even 3-per-cent. strengths may be used during virulent attacks), is made by dissolving sulphate of copper in the proportion of 1½ lb. in 10 gallons (100 lb.) of water, lime being added in sufficient quantity to neutralize the acidity.

An acid bordeaux is more active than a neutral one, but it is liable to burn the foliage. An alkaline mixture is also very effective, but is less adherent than a neutral, which is really slightly alkaline by the time it is applied. A neutral bordeaux is therefore preferred in practice.

The bordeaux can be used up to the time the grapes are picked, and should be used as long as there is any fear of mildew and there is foliage to protect. The salts of copper are said to have a stimulating effect on the leaves of the vine, and we learn from the results of the experiments of Millardet and Gayon that any copper salts carried on the grapes to the fermentation-vat are precipitated in a very short time and carried away in the lees.

PREPARATION OF BORDEAUX MIXTURE.

Viticulturists who are not familiar with the making of the bordeaux mixture will no doubt find a few instructions for its preparation acceptable.

To make 40 gallons of 1½-per-cent. bordeaux—the mixture known in New Zealand as the 6–4–40—take a hogshead, knock one end in, and mark the inside of the barrel at the 20- and 40-gallon levels, ascertained by previously pouring 20 and 40 gallons of water into it. Place 6 lb. of bluestone in a piece of sacking and suspend it in 20 gallons of water till it dissolves; or a quicker method is to spread the bluestone on the bottom of the barrel, pour 4 or 5 gallons of hot water on to it, and when dissolved add sufficient cold water to make up the quantity to 20 gallons.

While the bluestone is dissolving take 4 lb. of freshly burnt lime (more or less lime, according to its degree of purity, may be required) and add water to it, little by little, till it crumbles to a fine powder, to which add 5 or 6 gallons of water. Mix well, and add the resulting "milk of lime" slowly through a sieve or piece of hessian to the dissolved bluestone—never the contrary—stirring the mixture vigorously until just sufficient milk of lime has been added to turn a piece of red litmus paper blue, or a piece of phenolpthalein paper red. Litmus paper can be obtained from any dealer in chemicals for a few pence, and phenolpthalein paper, which is generally preferred for the purpose, can be made by soaking white filter paper or blotting-paper in ¼ oz. (7 grams) of phenolothein dissolved in half a pint of spirits of wine, using it when dry. Failing these means, the bright blade of a knife or a new nail plunged into the mixture for one minute should not show any deposit of copper if sufficient milk of lime has been added.

When the mixture has been neutralized or is slightly alkaline, add the spreader and sufficient water to bring up the solution to the 40-gallon mark, stirring well to produce an even mixture. Either of the following spreaders may be added to 40 gallons of bordeaux: 4 oz. casein dissolved in 1 gallon water to which 1 lb. washing-soda has been added; or 4 quarts skim-milk; if the milk is sour, neutralize with a little lime or soda. If either of these materials is unobtainable, 3 oz. of dissolved soap can be substituted.

Bordeaux mixture should be prepared as it is required, and used during the day of mixing, as it loses its fungicidal qualities very quickly. Wooden, enamel, or earthenware utensils only should be used in its preparation, owing to the corrosive action of the copper salts.

IMPROVEMENT OF WHEAT AND OATS.

SOME RECENT WORK AT CANTERBURY AGRICULTURAL COLLEGE.

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(1.) Wheat.

THE selection from College Hunter's wheat which goes by the name of "Bell" has been tried against College Hunter's for still another year. The trial consisted of twenty-eight strips of Bell sown beside twenty-eight strips of Hunter's, under exactly the same conditions, and the result was that Bell exceeded Hunter's in yield by 4·6 bushels per acre. This strain was selected in January, 1921, and was merely multiplied for two years. Since then the following results have been attained:—

1923–24: Five field plots—Bell equal to Hunter's. Ten bird-cage plots—Bell beat Hunter's by 12 $\pm$ 1·7 per cent.

1924–25: Thirty-six field plots—Bell beat Hunter's by 3½ bushels per acre.

1925–26: Twenty-eight field plots—Bell beat Hunter's by 4·6 bushels per acre. Bird-cage plots—Bell beat Hunter's by 5 bushels per acre in a trial consisting of twenty-four small plots.

This later selection is apparently somewhat better than the original selection that goes under the name of College Hunter's. It has a somewhat denser head, but is otherwise indistinguishable from the Hunter's. Another trial of it is in progress this season, and if it proves satisfactory the strain named Bell will be multiplied for distribution.

Many crosses of New Zealand and foreign wheats are in process of selection at the College, but it is too early to make any report on them. One cross made in 1919 between College Solid-straw Tuscan and College Hunter's has been fixed, and now breeds true to Solid-straw, with strong chaff and high grain quality. About 280 families of the cross are now under yield trial, and are giving every indication of producing a really useful wheat. Millers to whom samples of the grain have been submitted consider it better than either Hunter's or Solid-straw, and one stated that he considered it the best wheat he had ever seen in New Zealand.

(2.) Oats.

In Algerians several strains have been coming on for trial against the strain A86, now known as College Algerians. Twenty-four half-drill strips of each were sown against twenty-four half-drill strips of A86, and the averages gave the following results, the yields being shown in bushels per acre: A86, 73·0 bushels; B49, 75·1 bushels; D4, 71·5 bushels; D17, 71·8 bushels. Strains D4 and D17 have therefore been dropped, but B49 will be given a further trial.

The history of B49 to date has been as follows:—

Harvest of 1921: One of the best ten out of one hundred strains

1922: One of the best four out of these ten.

1923: No yield trial—multiplication only.

1924: Five field plots of each of nine strains. B49 was the best of all, A86 coming next.

1925: Thirty-six half-drill-strip plots were tried against thirty-six of A86. B49 was the better by 7 bushels per acre.

1926: Twenty-four half-drill strips against twenty-four of A86. B49 was the better by 3·1 bushels per acre.

B49 is therefore a promising strain. It is being given a further trial this year, and a stock of pure seed is being produced for distribution when its superiority to the present College Algerians is finally demonstrated.

In Gartons no success has ever been achieved here, probably because the variety is continually selected by its original producers. Three strains were put under test last year, twenty-four half-drill strips of each being tried against adjacent strips of bought seed. The results were: Commercial beat strain C3 by 2·8 bushels per acre, C12 by 4·5 bushels, and C1 by 2·4 bushels. The strains have therefore been abandoned.

In Duns the strain known as College Duns was tried in a similar elaborate fashion (necessitating the separate sowing, reaping, and threshing of seventy-two different plots) against new strains that had been multiplied sufficiently to put under conclusive test. College Duns beat C15 by 10·5 bushels per acre, C29 by 7·5 bushels, and C12 by 7·5 bushels. The three strains have therefore been abandoned.

In Danish oats only one strain had reached a stage to be tried against the established College strain. The new strain was beaten by 6·3 bushels per acre in a twenty-four-plot half-drill-strip trial.

Summary.

In wheat a new selection bids fair to surpass College Hunter's in yield. The Hunter's-Tuscan crossbreds now at the yield-trial stage promise to produce a wind-resisting wheat of high milling-quality.

In oats a new strain of Algerians is almost certain to excel the present established strain; but in other varieties the strains at present on the market are better than any of the new selections that have been under trial at the College.

NOTE.—In the foregoing record no figures are quoted that are not statistically significant.

OATS FOR CARRYING FIRE ON BAD BURNS.

THE sowing of oats on a bad burn with the object of securing a good fire over the area when the grain has ripened has been tried with a varying amount of success in several bush districts. The practice opens up great possibilities, for the securing of a hot fire is possibly the main factor in the success of a good grass sward in country tending to secondary growth. Oats or rye-corn would be the most suitable for the purpose in question. A bulky oat which tillers well, such as Black Tartarians, should be sown at the rate of 2 to 3 bushels per acre during autumn. To minimize the ravages of birds, the seed should be treated with red-lead or some other preparation, and other precautions, such as scaring the birds with gunshot, would be advantageous.

—*Fields Division.*

THE CONTROL OF WEEDS.

(Continued.)

3. METHODS OF DISTRIBUTION.

A. H. COCKAYNE, Director of the Fields Division.

THERE are many methods whereby weeds may become distributed from place to place, whether by means of seeds, spores, or individual pieces of the growing plants themselves. A clear conception of the various ways in which each individual weed is likely to be disseminated is of importance, inasmuch as this knowledge may often lead to management practices being adopted that will lessen the danger of spread. So far as our introduced weeds are concerned, they have been brought into this country, either accidentally or intentionally, in the ordinary commercial intercourse with other countries.

PRINCIPAL MEANS OF WEED-INTRODUCTION.

The following are the principal means by which weeds have been and are being introduced in overseas transport :—

As Seeds or Plants intentionally introduced for Cultivation on Farm or in Garden.

Just as the introduction of animals from other countries for sport, pleasure, and professedly economic purposes has led to the development of animal pests, so intentional plant-introduction has been the cause of the establishment of plant pests in the shape of weeds. The number of garden or farm-crop plants introduced that have become naturalized is not large, but among them are numbered some of our most noxious and dangerous weeds. Familiar examples are blackberry, originally introduced as a hedge and orchard plant ; sweetbrier, introduced as nursery stock ; and gorse and broom, introduced for hedge-plant purposes. The majority of the intentionally imported plants that have become serious weeds are of a shrubby nature, and the desire for live hedges has been responsible for the introduction of many plants that have become either generally or locally distributed as weeds. To those already mentioned, hakea, barberry, and elderberry can be added.

When one considers the vast number of different species that have been introduced and the small number that have become naturalized to any extent it is clear that the danger of importing plants that may become dangerous is not really very great so far as numbers are concerned ; but at any time it is likely that a plant may be introduced that may become an unmitigated pest. For this reason it would appear to be a useful safeguard if there were some legislative regulations whereby promiscuous importation could be, if not checked, at least supervised to a certain extent. At the present time any plant, no matter how harmful it may be in its original home, can be freely imported, and certainly there should be some power whereby plants distinctly likely to be troublesome here could be refused admittance.

As Seed Impurities in Agricultural Seeds generally.

The majority of our introduced weeds of agricultural and pastoral land can be traced to this source—for example, thistle, dock, ragwort, spurrey, and a host of others. As both our annual crop seeds and grassland seeds were originally almost entirely introduced from Europe, it is easily seen most of our weeds are of European origin. The importation of weed-seeds in imported grasses and clovers goes on year after year, and tons of such a weed as sorrel are annually imported in clover-seed. This source of introduction in imported seed does not now result in the production of many "new" weeds, but simply means the bringing in of seeds of weeds already established here. Here again, however, it is likely that new weeds not present in the country may from time to time gain a footing.

No administrative action has been taken in New Zealand to limit the importation of weeds in ordinary commercial agricultural seeds; but many countries have stringent laws against the importation of any seed containing more than a certain percentage of impurities, or prohibiting the importation of any seed containing seeds of certain specified plants—generally, strange to say, the specified plants being established ones in those countries where the laws are in operation. In general it can be said that legislation against the introduction of any specified weed-seeds is quite ineffective, and only results in harassment of the seed trade without affording any real and sure protection.

There are, however, two methods of dealing with imported seed that appear to be worth adoption. One is prohibiting the importation of any agricultural seed containing more than a certain percentage of impurities. This in no way would stop the introduction of weed-seeds, but it would eliminate badly cleaned seed, would raise the general standard of all imported lines, and be decidedly beneficial. The other method that would appear to be sound and practicable is the examination of all imported seed, and the rejection of that containing seeds of plants not already established in New Zealand and which are clearly objectionable in those countries where they are growing. Without doubt, the matter is largely in the hands of the farmer himself by buying only seed guaranteed by the merchant to be free from any objectionable impurities.

As Seed in Ships' Ballast.

At one time this was a quite fruitful source of weed-introduction, but with the present almost universal use of water ballast is no longer serious. American wild rice—a bad grass-weed liable to block drainage-channels in the Northern Wairoa district—Bathurst burr, and quite a number of South American weeds owe their presence in New Zealand to ships' ballast.

As Seeds in Packing-material.

Straw and other material used in the packing of commercial goods can frequently contain weed-seeds. For instance, the horned poppy, abundant on sandy soils around the Wellington coast, was introduced in machinery imported for the Patent Slip at Wellington, and Californian-thistle seeds have been found in the straw wrappers around bottles.

As Fodder used for Stock during Overseas Transit.

This method of introduction was very common in the early days of settlement, but does not exist at present, as under Stock Act Regulations no fodder used for live-stock on board ship is allowed to be landed. Fodder, and particularly chaff, which is frequently imported into New Zealand, often contains considerable quantities of weed-seeds; but, generally speaking, they are of plants that are already well established here. Whenever importations of produce are being made on an extensive scale the danger of weed-importation is stressed by the local farming community; but certainly the clear method whereby this danger can be eliminated is for New Zealand to grow the whole of her stock-fodder requirements.

On Imported Stock.

Certain weed-seeds, especially those liable to cling to wool or hair, are quite likely to be imported on live-stock. Thus many of the Merino rams imported during the past few years contained quantities of burr clover in their fleeces, and Bathurst burr has been imported from time to time in the same way.

MEANS OF WEED-DISSEMINATION WITHIN NEW ZEALAND.

There are three main agencies of dissemination of weeds throughout the country—natural, human, and animal.

Natural Agencies.

Wind.—Wind is the most potent natural agency in the distribution of weeds, and many plants have developed seeds of a type that render them capable of being distributed long distances even by winds of moderate intensity. Well-known seeds of this character are particularly common in that family known as the Compositae—the thistle and daisy family. They are mostly provided with feathery structures that enable the seeds to be suspended in the air for long periods. At the present time there is hardly any forest country in the North Island that when cut down and burnt will not almost immediately produce an abundant crop of thistles or similar weeds, due to the immense number of wind-borne seeds that are in or on the ground. The clouds of thistledown that one so frequently sees moving along in the wind are a striking testimony to the effect of wind on seed-dispersal.

The fact that forested country may annually have virtually tons of weed-seeds falling on the ground, and yet there is no establishment until the forest has been opened up or removed, can be viewed as giving the key to rational weed-avoidance. It shows how difficult if not impossible it is for plants to gain a foothold if suitable conditions for establishment are absent. So far as weed-control is concerned—on grassland, at any rate—it is the adoption of methods making establishment difficult that is biologically sound.

Running Water and Floods.—Streams and rivers, particularly when they are in flood, carrying as they do immense quantities of soil, are an important source of weed-dissemination. Not only seeds, but portions of plants themselves may by this means be transported great distances. The distribution of goat's-rue over all the land periodically flooded by the Manawatu River is a striking example of the water-dispersal of a weed, and there are many such examples in New Zealand.

Human Agencies.

General Transportation of Goods.—The main distribution of weeds by human agency comes about in the general distribution of agricultural materials in the course of their ordinary transportation over the country. Oats, chaff, hay, and other transported fodders, such as feed-meals that have been insufficiently ground and which are contaminated with weed-seeds, all play an important part in weed-distribution. With regard to certain weeds, notably Californian thistle, contaminated fodder has been more responsible for rapid and general distribution than has been the use of impure seed for sowing purposes. In the case of Californian thistle a peculiar idea has arisen in districts where thistle-infested oats and chaff are not uncommon—namely, that the seeds of this thistle will not germinate unless they have passed through an animal. It has been repeatedly demonstrated that such is not the case; and one of the plots at the recent Dunedin Exhibition, with an abundant crop of Californian thistle derived from seed taken from an infested line of grass-seed, clearly showed the fallacy of such an idea.

The avoidance of weed-distribution in contaminated fodder appears to be almost impossible. The Australian system of prohibiting the sale of such material has in practice been found to be more or less unworkable, and cannot in any way be carried out so as to fulfil its objective. It certainly must be said, however, that the indiscriminate distribution of weed-contaminated fodder in New Zealand has and is intensifying our weed problems; therefore it would appear to be sound to reduce this source of distribution so far as practicable. In the first place, the farmer on clean land should exercise great care in his purchases of fodder, and always bear in mind that the buying of weed-infested material will tend towards reduced production and increased expenditure on his farm. Again, the farmer likely to produce such material should carry out all practical methods to minimize the damage he is liable to cause the country. In this respect the clear recognition that he is damaging the country at large by selling badly weed-infested material without doubt would do much good in influencing him in not growing sale crops on the notoriously dirty portions of his farm until they were more or less adequately cleaned. It should also influence him to take advantage of certain practices with regard to early and late sowing and early and late harvesting, whereby the ripened weed-seed crop would not coincide with that of the crop he grows and intends to sell.

The policy of crop quarantines in different localities, and the prohibition of the sale of weed-infested crops, should, in my opinion, be regarded as a last resort. Education, rather than compulsion and restriction, is more likely to have permanent benefit, and the use of clean seed and the production of clean crops should be looked upon by every farmer not only as a necessity but as a duty.

Farm Implements.—These implements are a frequent source of weed-dispersal. This is especially true of threshing-machines and drills. It is hard to see how the position can be improved, but the real recognition that they are sources of contamination would at least do some good, and tend to their better cleaning, particularly in the case of threshing-machines.

Stable Manure.—Stable or farmyard manure is often a source of weed-distribution. Care should be taken to store manure in such a

way that the fermentation processes really destroy the weed-seeds present. The proper rotting of stable manure should be looked upon as essential. Unless such rotting is carried out the disadvantages of stable manure as a means of infesting land with weeds may outweigh its advantages in increasing the fertility of the land to which it is applied.

Animal Agencies.

There are two main types of animals responsible for the dissemination of weeds—namely, ordinary farm live-stock and birds. Ordinary farm live-stock, such as horses, sheep, and cattle, distribute weed-seeds either by carrying them on the outside of their bodies or by eating and then voiding them in their excreta in a condition capable of germination. The influence of live-stock in both these directions is very great—fortunately, indeed, in many cases to the advantage of the grassland farmer, for useful as well as noxious seeds can be so distributed over wide areas at no cost to the farmer. For example, the spread of white and many other clovers on to land where they have never been sown can be almost wholly attributed to the action of live-stock. The swamp-reclaimed portions of the Ruakura Farm of Instruction offer remarkable examples of the value of stock in spreading useful seeds. Cattle and horses are greater factors in the spread of weeds by means of manure droppings than are sheep, but the latter carry large quantities of seeds in their fleeces, particularly during certain times of the year.

Just as many seeds are specially constructed to enable their easy conveyance by the agency of wind, so many seeds are constructed by nature in a manner that carriage on the wool or hair of animals is facilitated. The following are some examples of these adaptations :—

Minute size of seed enabling it to remain for a considerable time in the fleece of a sheep : Foxglove and mullein are good representatives of this class. The presence of foxglove on a farm, often attributed to the use of impure seed—a supposition generally wrong—can often be traced to the bringing of stock from foxglove-infested country.

Fruits or seeds with hooks or barbs: Piripiri, burr clover, and Bathurst burr are familiar examples of weeds that are capable of being widely distributed by live-stock.

Fruits or seeds having hairs : Tauhinu and many of the smaller-seeded composites are provided with a hairy pappus, and large quantities of such seeds may be carried in fleeces. Danthonia, with its hairy seed, is regularly distributed over wide areas.

Fruits or seeds that tend to pierce the skin : Barley-grass, hair-grass, rice-grass are representatives of this class. The distribution of the last-named is valuable.

Buying-in of Stock.—In the purchase of stock considerable attention has often to be paid both to the weeds present on the land they have been grazing on and the time of year they are bought, in order either to avoid or at times to encourage the distribution of seeds on to any particular farm. Thus, for instance, in coastal districts great care has often to be taken to avoid the purchase of stock from tauhinu country during the period when the seed is likely to be in the fleece, which is in late summer and early autumn. Again, the purchase of stock from piripiri-infested country is quite dangerous for new burn country that

is beginning to lose the fertility derived from the ashes. Foxglove is another weed that is likely to be introduced by bought-in stock.

As has been mentioned, the seeds clinging to the wool of stock are quite likely to prove advantageous in certain cases. This is particularly true of country which it is desired should come into danthonia. The purchase of sheep from country where danthonia has seeded freely is regularly effected with the express intention of bringing in considerable amounts of the seed in the fleeces.

Birds are a frequent cause of weed-distribution. Among weeds that are spread far and wide by this means may be mentioned blackberry, ink-weed, and black nightshade. Waterfowl, again, frequently convey seeds over long distances. The general distribution of the floating buttercup within a few years of its introduction is a case in point.

DISTRIBUTION ON THE FARM.

So far as the distribution of weeds on individual farms is concerned, all the methods above enumerated come into play with regard to their actual conveyance, but the actual increase and infestation of any farm, or any portion of a farm, with weeds is largely a matter of what type of management is carried out, and whether it tends to assist or restrict their establishment and spread. The principles here involved will be dealt with later when methods of control are being discussed.

(To be continued.)

WATER-HYACINTH IN HAWKE'S BAY.

WITH reference to the note, "Water-hyacinth in New Zealand," published in last month's *Journal*, inviting the supply of local information and experience regarding this plant, Mr. L. M. Monckton, of Waipukurau, writes to the Editor as follows :—

"I have two dams, one of about 1 acre and the other of 2 acres. Thirteen years ago there was no sign of water-hyacinth on either, but a few years later it appeared on both, evidently brought by wild ducks from other dams in the district, where it has been for over twenty years. The weed started from the edges and worked towards the centre of the dams, which are now covered with the hyacinth, except for a small portion in the deepest parts near the keys. So far it has done no harm—rather the other way, as it has stopped the waves which caused erosion of the keys of the dams, and ducks frequent the dams in greater numbers than they did, owing to the shelter and feed caused by the plant. It appears to have done no harm to the water from the stalks rotting. Cattle are very fond of the weed, wading out into the dams till the water is almost over their backs, and pulling up and feeding on the succulent roots. The hyacinth is spreading into the slow-running creeks, and I have wondered if there was any danger of it harbouring the small water-snail that appears in the life-history of the liver-fluke."

The main factors in the management of established lucerne stands are avoidance of early cutting, avoidance of continuous grazing, winter cultivation with spring-tooth or rigid cultivators, top-dressing with superphosphate, and occasional liming.

For permanency of the best pasture-plants and maximum yields of annual crops efficient drainage is essential. When drainage is not provided satisfactorily by nature artificial methods must be resorted to.

SOME IMPRESSIONS OF FARMING IN THE NORTH ISLAND.

Paper read by G. S. PEREN, B.S.A. (Toronto), Professor of Agriculture, Victoria University College, Wellington, at the Annual Conference of the Royal Agricultural Society of New Zealand, May, 1926.

IT is obvious that farming in the North Island, when taken as a whole, is gradually changing from comparatively extensive to more intensive methods, the degree of intensity reached varying with different districts. Extensive methods are invariably the practice in young countries possessing plenty of land, until, in the course of time, the pressure of economic factors brings about changes, which continue until a point is reached when costs of production, standard of living, and markets call a halt. Changes in costs and the gain or loss of markets for certain products may have marked effects on the kinds of farming followed, but the degree of intensity reached in any line will be governed largely by the three aforementioned factors.

It would be, undoubtedly, to the interest of all that New Zealand should produce the greatest volume of produce compatible with satisfactory profits for the producer, and I have been particularly interested in the possible lines of development in this respect. We hear a lot about Denmark and the standard of cultivation in some of the other European countries, and while it is very pleasant to travel through these countries and to note the way in which many parts of them are cultivated and the amount which the land is producing, yet to visualize a similar future for New Zealand would be but idle. The prime factors in each case are different, with the one exception of export markets, and the respective advantages and disadvantages do not cancel out. To endeavour in a comparatively few decades to bring a big body of raw country, mostly in forest and either hilly or mountainous, up to the standard of improvement of what we are pleased to call "Western civilization," and at the same time to be pioneers so far as standard of living is concerned, is to set yourselves a difficult row to hoe when at the same time you must compete in your markets with Continental Europe.

I am not anxious to see a nation of small holders as understood in Europe, but I do think that we should all like to see the country farmed in such a way that it would be producing reasonably near the maximum of which it is capable. If, in various ways, this degree of development is made impossible, much very valuable raw material will be deliberately sacrificed.

I think one can assume that dairying will gradually take possession of the bulk of the land suitable for that purpose. It seems to me that this is almost certain to take place, since the value of this land is so high that when large places come on the market they must in most cases be broken up, since no one person can afford the total purchase price; and those who take portions will in many cases be forced into dairying as being the most profitable line, and, generally speaking, the only line capable of paying off the big purchase price. I fancy that this process will gradually change most of the high-priced country

into small to medium holdings devoted to dairying, the only offset being those cases where a man owns his place free of debt and is so well off that he can afford to take less off his land and, from preference, changes over to sheep. Prices of dairy-produce have their ups and downs, but dairying is generally conceded to yield a higher profit per acre on suitable land than does sheep-farming.

The next question that rises in one's mind is the extent to which this land can be made to give greater yields at a satisfactory profit. The carrying-capacity may even now be relatively high on account of the favourable climate, but it does not follow that it is not possible to take even further advantage of the climate. I do not propose to discuss the very best dairying flats, but rather land nearer the border-line of dairying. It does appear to me that by a more liberal use of top-dressing and the growing of more hay and forage crops such land could be made to carry far more stock and do it better. I am frequently told, however, that the latter crops are very expensive and frequently do not pay, and to this I can only reply—since I have as yet no data on which to base my own opinions—that, if true, it is a very serious thing for the country, as being a reflex of very high costs of production. It means that dairy-farming, of all lines, can only stand the cost of a very small area of arable land, and that not only the best but even second-class pasture is more profitable by itself than with forage crops, in spite of the fact that it does not carry cows satisfactorily through a season without supplementary feed. First-class pastures probably are more profitable than arable, and in their case the latter should be kept to a minimum; but on the poorer dairying-country that minimum should be very much larger to produce efficiency, yet such a minimum is apparently unprofitable. If true, it is very unfortunate, as it will restrict the dairying-country, the area which lends itself especially to better methods, greater production, and closer settlement. As most of you are no doubt aware, people in many countries are dairying successfully on land on which you would never dream of running anything but beef cattle and sheep: it is all a matter of costs in relation to prices. The higher the total cost of production the less the volume of produce it will be possible to get out of your land, since you market in Europe and not in the country where the costs originate, and where prices should be more or less compatible. European prices may rise and help you out, but higher prices would offer a very big profit to European countries with much lower costs, and they would tend to increase their production, with a consequent lowering effect on prices.

Turning to the further development of the sheep-country, better subdivision and pasture-management, and, where feasible, top-dressing, will in many cases undoubtedly improve carrying-capacity. At the same time I fancy we shall have to face in some cases a shrinkage in hill country which economic factors make impossible to handle—*i.e.*, land on the boundaries of farming which probably should not have been taken up.

So far as population is concerned, one supposes that gradually the larger stations will be broken up and the average size of runs decrease. With respect to this aspect, it has struck me that in many cases there is a real danger of overdoing subdivision. A lot of country can only

be handled by big men with plenty of capital; and again, some of the smallest subdivisions appear to me to be uneconomical from the point of view of the full employment of the owner's time.

I have been rather appalled at the amount of hill country which is "going back." In a mountainous country, however, one must expect a lot of poor land. Apart from the exhaustion of the residual effects of "burns" and the drain of continuous stock-raising, one must expect deterioration due to topography once the forest covering is removed, unless the soil is very carefully handled and a good sward is maintained. In this respect I have frequently noticed men ploughing high-lying hillsides of a very light nature which had "run out," but which, in my opinion, should never be touched by a plough. Such a procedure may work for some time, but in the long-run the washing of such soils will reduce the fertility to a very low standard. It would be wiser to be content from the beginning with a good second-class permanent pasture produced by top-dressing. It seems to me that the best we can hope for is top-dressing of the more accessible country where costs permit, and a reversion of the more inaccessible country to a more or less stable standard of pasture determined by local factors. In many cases the standard will be distinctly third class, but we shall be lucky if we can hold that clean, and to do so will require careful handling, subdivision, and spelling, and perhaps, where possible, burning and reseeding with more suitable grasses. Such a statement implies a shrinkage in the carrying-capacity of certain types of country, and this, I fancy, will be the case, and must be realized when considering the future of the industry.

So far as undeveloped land is concerned, while I have seen a lot of it, including much of the North Auckland Peninsula as far up as Kaitaia, and have formed certain opinions, I do not propose to touch on the subject until I have been longer in the country. I have found a tendency in some people to regard all land as potential farming-land—the "Open sesame" being science. I would remind you that even in European countries there are areas which do not pay to touch, and that in very many cases the greatest difficulty in the problem of applied research is to find a treatment which is sufficiently cheap. The poorer the inherent nature of a piece of country the greater the difficulty. The higher the cost of production in relation to market prices of produce the sooner land becomes unprofitable to handle as we work down the scale of classes of land. High prices of an apparently permanent nature tend to bring into use land which previously did not pay to touch, but a continuation of high prices also tends in the course of time to encourage the growth of costs of production.

Personally I feel that there is a great field for expansion through the drainage of low-lying and swamp areas. I regard this as one of the most promising lines of development in the country, judged from the point of view of kind of land. Feasibility of drainage and cost are the two big hurdles, but there is the potential land if you can only get the water off it successfully at a reasonable figure. One is very pleased to see the work in progress on the Hikurangi and Kaitaia Swamps. Even though some of the lowest parts may always be wet, a big volume of produce eventually should be added to the country's

output. Such land will, I fancy, prove more attractive to men starting out than land on the margin of the profitable country where costs of purchase and "bringing in" may be greater than the market value of the final product. To this there is the exception of good land at present under timber leases, &c., which may be thrown open from time to time, and certain other classes of land such as "gum" land and certain pumice country, the handling of which is rather in the experimental stage.

I think that most new-comers are impressed with the need of farm drainage throughout the country. Cost is again the stumbling-block, and one must not expect a new country to be thoroughly developed in respects of this sort. Such improvement will, I hope, come slowly but surely. I do think that some men dismiss the project too hastily through lack of appreciation of the benefits to be derived therefrom. Again, others lose faith through poor results following faulty planning or an insufficient drainage system. However, one sees many farms throughout the country where small areas, usually of the best soil, are not doing more than half of what they are capable merely for lack of drainage.

Reverting to the subject of forage, I cannot say that I have been impressed with the general standard of the crops grown. This, I fancy, is due to a lack of appreciation of the value of the careful handling of soil and to insufficient intercultivation of the crop. You are primarily graziers and stockmen, and—forgive me for saying so—it is my experience that men of these interests are not, as a rule, such good arable farmers as those who are regularly engaged in a large amount of arable work. I would remind you that on land set aside for a rotation of forage crops, oats, and temporary pastures—which, with the growing use of top-dressing and permanent pasture, will, I fancy, become a feature of most farms—a cleaning crop is essential, and this means intercultivation. The only other check, and one far less efficient, is a smother-crop. I feel sure that a little extra attention would pay for itself in increased yields. Weeds are a very much more serious competitor with crops than one might imagine. Incidentally, the percentage of waste in many of the haystacks one sees must be enormous.

The interest which is being taken in top-dressing and pasture-management is very encouraging. It appears to me that, taking all factors into consideration, top-dressing is more capable of effecting a big increase in the production of the country than any other one method available. Where conditions permit, the use of fertilizers to produce permanent pasture is far better practice than putting in a plough as soon as serious deterioration occurs. Under careful management permanent pastures improve with age—one might almost say "They become a strength unto themselves." The amount of humic matter in the top soil is greatly increased, and a medium is formed in which grows a really wonderful turf which is far more drought-resistant and self-supporting than new pastures. At Home this condition is considered very valuable on account of the time required to produce it, and it is considered a sin to plough up good grass which has reached this stage. A certain area is essential for forage crops, and temporary leas for certain lines of

farming, but unless climatic conditions dictate I do not consider it wise to bring the whole of a grazing-farm into a rotation, however long.

I have been impressed at the omission of the rolling of pastures. It is true that the small amount of frost is not likely to cause any heaving of the grass-plants, but as a remedy for "poaching" and the habit which grasses have of "lifting" themselves I consider it well worth while. It does not take long, and can be done by a boy. After all, we know the way in which a lawn benefits from rolling.

I would emphasize that grazing is an art. Pastures are a crop which requires consideration and careful management, as in the case of other crops. A man should know his grasses and keep a continual eye on their behaviour. To treat them as so much "grass" on which to run stock, and to leave them largely to take care of themselves, is to drop money.

Live-stock is a very controversial subject, the question very often being a matter of opinion. I may say, however, that I think that, generally speaking, the quality of the stock in the country is good. There is plenty of room for improvement, but that applies to all countries. Personally, I think that some of the Jersey breeders are going in for too fine a type of beast. You may say that I have been brought up to the American type of Jersey, but I am basing my remark solely on my ideas of type as exhibiting the constitution necessary to stand up to very exacting work generation after generation. I have been disappointed in the dairy Shorthorns—not only quality but dairy type is so frequently missing. Again, beef Shorthorns do not seem to be up to the same standard as the other beef breeds in the country.

Naturally, I have been surprised at the scarcity of pigs in the country. To go into the subject fully and discuss ways and means would require a separate paper, and I shall merely confine myself to the statement that if you are aiming at the bacon-market I think it would be sound policy either to select your Berkshires very carefully for the lengthy type, or else to use a breed or breeds which conform more closely to what is recognized as the correct bacon type. Although I have been told by an English importer that he was getting good carcases from New Zealand, yet I think that, while you may be producing reasonably good sides, it would be better business to use a pig which did not waste so much food in growing large quantities of the cheap cuts, particularly neck, shoulders, and jowl. The short chunky type of Berkshire is nothing more than a porker or lard-hog—excellent for that purpose, but far from suitable for bacon. The lengthy type of Berkshire has a better side, but even in the cross with the Tamworth, which is a good bacon pig, that useless weight of flesh in the fore quarters and neck is usually in evidence, with a tendency to too much belly-fat. The most valuable meat on the bacon pig is the side from the back of the shoulder and including the gammon. The type of pig required by the bacon-curers has been so clearly and definitely described by them on many occasions in their propaganda to encourage uniformity that the subject admits of no doubt. I think that people often become very fond of the Berkshire because, on account of fineness

of bone, coupled with a capacity for doing well, they are usually nicely rounded off at all points and thus appear such a well-finished article. They undoubtedly produced excellent Wiltshire sides in the days gone by, but the public is now demanding a different type of bacon, and the curer is bound to regulate his price to cover the amount of low-value meat which he has to buy along with the good cuts.

Another feature of this country which has impressed me is the lack on most of the larger places of houses for married farm hands. I know the reason, but that does not help matters. A good comfortable house and pleasant surroundings are a wonderful influence in keeping help, and the value of good men who have been with you for years can hardly be overestimated. They know your land and its peculiarities, your stock, and your ways, and they save you a tremendous amount of extra work, worry, and bad temper. I can quite understand that lack of accommodation must accentuate the difficulty of obtaining help of the right quality.

There are, naturally, a number of other points on which one could touch did time permit, and, again, if one were more certain where one stood as regards costs. It would appear that the costs of starting to farm are very high, and that many who have started in the last few years are in difficulty, sometimes no doubt due to bad luck or undue optimism. However, it should be remembered that the financial soundness of the industry should be gauged by the experiences of those who have purchased their land at recent prices (excluding absurd figures), rather than of those who bought in the days when the availability of new land kept prices down.

In conclusion, I may say that I think that the extent to which the country has been developed in such a short time reflects very great credit on the pioneers. The climate is indeed a wonderful asset, and I think that the land should be capable of producing a much greater volume of produce than at the moment. That this development will be economically possible I sincerely hope, since the country is comparatively small if one subtracts the mountain areas, yet is entirely dependent on its agriculture, and likely to remain so for some considerable time. I myself do not think that the point has been reached where the Law of Diminishing Returns comes seriously into operation, and I feel that more attention to detail and, for example, the cost of an extra hundredweight of fertilizer or a little more cultivation, would increase yields quite out of proportion to the slight additional cost.

It is far from likely that you will agree with all my remarks, and perhaps I shall change some of my ideas in the course of the next few years; these, however, are my first impressions.

Noxious Weeds Order.—The Gore Borough Council has declared that Californian thistle and ragwort shall be deemed *not* to be noxious weeds with that borough.

For concrete-work material should be used in the following proportions: For posts—one part of cement to five or six parts of aggregate; for light but very strong work—one part of cement to four parts of aggregate; for bulky work not subjected to wear or stress—one part of cement to eight parts of aggregate.

CASTRATION OF LAMBS WITH THE BURDIZZO INSTRUMENT.

W. R. DAVIS, M.R.C.V.S., Departmental Veterinarian, Petone.

AT some of the freezing-works of the Dominion during the past few months a number of ram lambs have been met with in which an abnormal condition of the testicles and their appendages has been observed, consisting in some cases of mere atrophy of the organs and in others of inflammation, hæmorrhage, &c. An endeavour was made to ascertain what had given rise to the condition, and it was suggested by the Director of the Live-stock Division that as a number of Burdizzo castrators had been imported, and inquiries received as to the merits of the instrument, the cause might lie in improper operation of this new method. Later this was found to be the explanation.

The Burdizzo castrator is applied to the skin of the purse above the testicles, and the cords crushed and obliterated, there being no cutting. It may add to the clearness of explanation if a few remarks are made regarding the structures involved. In the fœtus the testicle lies behind the kidney, and shortly before birth it travels down to the middle line of the belly (opposite to where the abdomen joins the thigh). Here in the belly-wall there is a slit (inguinal ring), and through this the testicle passes to the purse or scrotum. In its passage through the slit the testicle pushes in front of it the membrane that lines the inside of the belly (peritoneum). This then comes to cover the inside of the purse, the testicle, and the structures that make up the spermatic cord on which hangs the testicle, these structures consisting of artery, vein, lymphatics, nerves, and a firm tube that carries the seed up from the testicle. The artery does not run down in a straight line, for, being as it were too long, it describes a series of curves in its course; and in castrating by any method it is important to remember this disposition of the vessel.

The Burdizzo, an Italian invention, was first introduced into England in 1912 by Mr. T. Brown, F.R.C.V.S., of Invergordon, who has used it ever since on bulls and tups with good results. Mr. Brown states in a letter: "All you have to do is to hold the spermatic cord firmly beneath the skin whilst any person closes the instrument over both the skin and cord. It is quite a bloodless and aseptic operation. The testicle may swell for a day or two, then it gradually atrophies, and disappears completely in a few weeks. It is quite as humane as any other method, and I have never seen a bull or tup show any signs of illness; they can be turned out in any kind of weather."

In the cases alluded to here the castrator had been applied too close to the testicle, and in many instances to the organ itself, the result being that the structures of the cord were not obliterated and the operation was followed by inflammatory and hæmorrhagic changes, suggesting, indeed, that the condition was the result of worrying by dogs.

Farmers who propose to use the instrument are advised to see that a grasp is taken on the cord well above the testicle. In order to do this the testicle should be grasped in one hand and pulled down so as

to tense the cord and efface the curves of the artery; the other hand should hold the cord in position. The instrument can then be applied and firmly closed by an assistant.

Some weeks should elapse before the animals are suitable for slaughter. The castrator is not suitable for very young lambs.

LAMB-FATTENING ON FORAGE CROPS.

TRIALS IN AWATERE DISTRICT, SEASON 1925-26.

F. W. Greenwood, B.A., Instructor in Agriculture, Blenheim.

In response to requests from the Awatere branch of the Farmers' Union (Marlborough) the Department of Agriculture undertook in September last to conduct a local co-operative experiment in lamb-fattening with supplementary forage crops. It was unfortunate that arrangements for these trials could not have been made earlier in the season, as the time available for cultivating the ground prior to the sowing of the various crops was far too short to allow of a sufficient length of fallow being given. The Blenheim branch of Messrs. Wright, Stephenson, and Co. kindly undertook to supply all the seed and manure necessary for experimentation. We are also indebted to Mr. C. P. Gainsford, on whose farm, at Seddon, the trials were conducted, for his close attention so freely given to the details of the experiment during its progress, and to Mr. N. West and Mr. C. Walker, stock agents, Seddon, for their help in drafting and classifying the fat lambs.

The paddock selected for the work was down in a temporary pasture consisting of Italian rye-grass and white and red clover. This pasture had been in existence for two seasons and had never been top-dressed. Previously the paddock had been cropped, the last taken being three cereal crops in succession—two of wheat and one of oats. Blood manure from a neighbouring slaughterhouse had been spread over the paddock from time to time, on an average of, say, once in three years.

The pasture was stocked mainly with sheep. The soil may be described as consisting of a mixture of alluvial deposits and papa. Eight acres were ploughed and worked for the sowing of crops, and this area was subdivided into four 2-acre blocks, and sheep-fences erected across the paddock to separate one block from another. Care was taken to eliminate the only interfering factor which might have been present in the shape of a row of *Pinus insignis* trees situated at the end of the plot devoted to peas, these trees being carefully fenced off to avoid the shade and shelter which might otherwise have been afforded to that section. Water was laid on to each plot by means of troughs filled by pipes from a tank, which was in turn filled by a windmill. The ground on these four plots was level, and about as even as could have been found. The soil is typical of flat country in the Richmond Brook, Seddon, Tetley Brook, and Seaview districts, somewhat poorer than the flats at Kaparu and Blind River, but roughly typical of many of the Ward, Dumgree, and Medway flats. A fifth area of the same size (2 acres, approximately) was fenced off from an adjoining lucerne-paddock, thus making five plots in all.

As much cultivation was given to the land as the short time at our disposal would allow, the ground being ploughed only once, disked once, harrowed twice, then rolled — admittedly insufficient tillage. Dwarf Defiance peas of the Marrowfat type were sown about 12th October at the rate of $3\frac{1}{2}$ bushels per acre. It may be stated here that the wrinkle pea, as a fodder plant for fattening, is much preferred to the ordinary field-peas—Partridge, and Prussian or Imperial blues—by Marlborough farmers. On 26th October rape in 7 in. drills, at 3 lb. per acre, and chou moellier in 21 in. drills, at 3 lb. per acre, were sown. There is reason to believe that where intercultivation can be practised the 21 in. drills are superior to the 14 in.—that is, drilling through every second coulter. The difficulty is that most farmers for various reasons do not intercultivate, so that probably the 14 in. drill will come into general favour. Japanese millet was sown on 27th October at 12 lb. per acre, the seed being mixed with the manure and sown through the manure-box of the drill. All the crops were drilled with 44 to 46 per cent. superphosphate at the rate of 2 cwt. per acre. Similarly, the lucerne plot was top-dressed with the same quantity of super per acre.

Right from the outset the peas made good growth, and when the lambs were turned on to the plots in January the crop had just matured, thus being at the right stage for feeding off. Judged in themselves they were easily the best crop in the paddock. It is very important to note that the fodder crops, until after the first draft of lambs was taken off, experienced the driest season Marlborough had known for ten years. Taking into consideration the season, the rape crop may be described as fair—better than the average in the district, but somewhat poorer than the best. Fortunately, the dry weather was not accompanied by serious trouble with the aphis pest. The chou moellier crop, considering the adverse weather conditions with which it had to contend, made quite a fair show. The millet was a failure. This may have been due to the fact that the preceding long wet winter had left the soil somewhat too cold for this crop. The lucerne made good growth prior to the lambs being turned on at the beginning of January. A hay-cut was made in November, and the hay stacked within the lucerne enclosure so that the lambs could nibble at it, it being considered that they should fatten better when hay was fed with the green fodder. This method was also regarded as something in the way of a precautionary measure against bloat.

As already indicated, the lambs were turned on to the plots early in January, forty lambs being allotted to each plot, with the exception of the Japanese millet plot, which was capable of carrying only twenty. The lambs, taken all through, were a fairly even lot when placed on the respective plots to graze. All were by English Leicester rams. It may be stated here that the common practice in the Awatere district is to cross the Leicester ram with the half-bred ewe, so that in the case of those lambs not sent away fat off their mothers or fattened off some supplementary fodder crop the quality of the wool may be maintained. In some of the very early districts, where a high percentage of milk lambs is easily obtained, the Southdown ram has recently been introduced with the object of breeding black faces. The lambs turned on to the plots at Seddon were at that time worth on the average about 18s. per head.

Mr. West, who made the first draft of fats on 2nd February last, stated that his classification on that day was well defined—that is, those lambs rejected as not fat were all such as would, on the average, require about the same time to fatten—another three and a half to four weeks. The results of the first draft were as follows :—

28	lambs off	peas	= 70 per cent.
18	,,	rape	= 45 ,,
17	,,	chou moellier	= 43 ,,
11	,,	lucerne	= 28 ,,
16	,,	millet	= 80 ,,

The millet was so infested with weeds (chiefly fat-hen) that the test of that crop could not in any way be considered a fair one. It was therefore decided to disregard the results from this plot.

At the date of drafting, after three and a half weeks of grazing, the pea crop was finished, as was likewise the Japanese millet. The rape, chou moellier, and lucerne were shut up to allow them to come away again. The lambs set aside as not fat were taken right away from the plots and turned out on to another part of the farm.

The report on the first draft of lambs sent away as fat to the Picton freezing-works was as follows :—

Lambs off Peas (28).

Grade.	Number.	Net Weight.	Average.	Price.	£	s.	d.
		lb.	lb.		£	s.	d.
To 36 lb.	8	259	32·37	At 9¾d. =	10	10	5
36 lb. to 42 lb.	2	76	38·00	At 8½d. =	20	10	2
Second quality (under 36 lb.)	18	503	27·94				
	28	838	29·92		31	0	7
Allowance for trucking and drafting, at 6d. per head ..					0	14	0
					31	14	7
Less railage					0	11	7
					£31	3	0

Average price per head delivered at works, £1 2s. 3d.

Lambs off Rape (18).

Grade.	Number.	Net Weight.	Average.	Price.	£	s.	d.
		lb.	lb.		£	s.	d.
To 36 lb.	11	323	29·36	At 9¾d. =	13	2	5
Second quality (under 36 lb.) ..	7	214	30·57	At 8½d. =	7	11	7
	18	537	29·83		20	14	0
Trucking and drafting, at 6d. per head					0	9	0
					21	3	0
Less railage					0	7	8
					£20	15	4

Average price per head delivered at works, £1 3s. 1d.

Lambs off Chou Moellier (17).

Grade.	Number.	Net Weight.	Average.	Price.
		lb.	lb.	£ s. d.
To 36 lb.	11	338	30·72	At 9¾d. = 13 14 7
Second quality (under 36 lb.)	6	175	29·16	At 8½d. = 6 3 11
	17	513	30·17	19 18 6

	£ s. d.
Trucking and drafting, at 6d. per head	0 8 6
	20 7 0
Less railage	0 7 2
	£19 19 10

Average price per head delivered at works, £1 3s. 6d.

Lambs off Lucerne (11).

Grade.	Number.	Net Weight.	Average.	Price.
		lb.	lb.	£ s. d.
To 36 lb.	7	220	31·42	At 9¾d. = 8 18 9
Second quality (under 36 lb.)	4	111	27·75	At 8½d. = 3 18 7
	11	331	30·09	12 17 4

	£ s. d.
Trucking and drafting, at 6d. per head	0 5 6
	13 2 10
Less railage	0 4 8
	£12 18 2

Average price per head delivered at works, £1 3s. 6d.

The second draft was turned on to the lucerne, rape, and chou moellier on 1st March, the numbers being allotted as follows: Lucerne, 19; rape, 28; chou moellier, 17. These lambs were worth approximately 16s. per head when moved on to the plots. It will at once be evident from the allotment of lambs that the rape had made far better growth than either the lucerne or the chou moellier in the interval from 2nd February to 1st March. It must also be noted that towards the end of February the drought broke, and, although the weather after that date was again somewhat dry, good heavy rains of 1 in. or more at intervals of ten to twenty days were experienced.

After the lambs had been on the plots for four weeks the second draft was made on 29th March. From the lucerne eighteen were taken off fat and one rejected; from the chou moellier sixteen were taken off fat and one rejected; from the rape twenty-seven were taken off fat and one rejected.

The following is a summary of the freezing-works report on the second draft :—

Lambs off Lucerne (18).

Grade.	Number.	Net Weight.	Average.	Price.	£	s.	d.
		lb.	lb.		£	s.	d.
To 36 lb.	7	224	32·0	At 8¾d. =	8	3	4
36 lb. to 42 lb.	3	118	39·3	At 7½d. =	3	13	9
Second quality (under 36 lb.)	8	238	29·7	At 7½d. =	7	8	9

	£	s.	d.
	19	5	10
Trucking and drafting, at 6d. per head	0	9	0
	19	14	10
Less railage	0	7	6
Average price per head delivered at works, £1 1s. 6d.	£19	7	4

Lambs off Chou Moellier (16).

Grade.	Number.	Net Weight.	Average.	Price.	£	s.	d.
		lb.	lb.		£	s.	d.
To 36 lb.	7	231	33	At 8¾d. =	8	8	5
36 lb. to 42 lb.	5	190	38	At 7½d. =	5	18	9
Second quality (under 36 lb.)	4	120	30	At 7½d. =	3	15	0

	£	s.	d.
	18	2	2
Trucking and drafting, at 6d. per head	0	8	0
	18	10	2
Less railage	0	6	8
Average price delivered at works, £1 2s. 9d.	£18	3	6

Lambs off Rape (26, exclusive of one reject dead).

Grade.	Number.	Net Weight.	Average.	Price.	£	s.	d.
		lb.	lb.		£	s.	d.
To 36 lb.	25	810	32·40	At 8¾d. =	29	10	7½
36 lb. to 42 lb.	1	38·25	38·25	At 7½d. =	1	3	11

	£	s.	d.
	30	14	6½
Trucking and drafting, at 6d. per head (27)	0	13	6
	31	8	0½
Less railage (on 27)	0	11	3
Average price per head (on 26) delivered at works, £1 3s. 9d.	£30	16	9½

Observations made four weeks after the second draft had been taken off the plots showed (1) that a fair growth of rape had come again, (2) that there was only a small growth on the chou moellier, and (3) that there was very little growth on the lucerne. It is important to note that very little of the hay in the lucerne enclosure was eaten either by the first or by the second group of lambs.

The following tables indicate the comparative values of the crops :—

Cost of Production of Crops: Labour, Seed, and Manure (Rent not included).

Crop.	Per Acre.	Per Plot of 2 Acres.
	£ s. d.	£ s. d.
Peas	5 6 0	10 12 0
Rape	2 8 3	4 16 6
Chou moellier	2 17 0	5 14 0
Millet	2 10 0	5 0 0
Lucerne	1 16 0	3 12 0*

* Allowing for haymaking and top-dressing.

Gross Gains on different Crops.

Crop.	Value when Lambs put on.	Value when Lambs taken off.	Gain.
	FIRST DRAFT.		
	£ s. d.	£ s. d.	£ s. d.
Peas	28 at 18s.=25 4 0	28 at £1 2s. 6d.=31 3 0	5 19 0
Rape	18 at 18s.=16 4 0	18 at £1 3s. 1d.=20 15 6	4 11 6
Chou moellier ..	17 at 18s.=15 16 0	17 at £1 3s. 6d.=19 19 6	4 3 6
Lucerne ..	11 at 18s.= 9 18 0	11 at £1 3s. 6d.=12 18 6	3 0 6
	SECOND DRAFT.		
	£ s. d.	£ s. d.	£ s. d.
Rape	27 at 16s.=21 12 0	26 at £1 3s. 9d.=30 17 6	9 5 6
Chou moellier ..	16 at 16s.=12 16 0	16 at £1 2s. 9d.=18 4 0	5 8 0
Lucerne ..	18 at 16s.=14 8 0	18 at £1 1s. 6d.=19 7 0	4 19 0

Summary.

Crop.	Gain from Lambs.	Cost of Production of Crop.	Net Profit or Loss on 2-acre Block.
	£ s. d.	£ s. d.	£ s. d.
Peas	5 19 0	10 12 0	4 13 0 loss.
Rape	13 17 0	4 16 6	9 0 6 profit.
Chou moellier	9 11 6	5 14 0	3 17 6 ,,
Lucerne	7 19 6	3 12 0*	4 7 6 ,,

* Including haymaking.

It will be seen from the above figures that there was an actual loss from the pea crop of £4 13s. The price of wrinkle-pea seed was high—18s. per bushel—thus costing £6 to sow 2 acres. Had field-peas been used, at 6s. 6d. per bushel, the seed would have cost £2 3s. 4d., thus reducing the cost by £3 16s. 8d. However, experience shows that the results with this class of pea would be poorer, so that there would most likely still have been a loss. The margin from the chou moellier crop was small—£3 17s. 6d. from 2 acres. Had the season been more favourable, however, there is reason to believe that the margin from this crop would have been considerably greater. In the case of lucerne

the cost of production was really only about 16s. per acre for top-dressing (£1 12s. for 2 acres). An amount of £2, however, was added for the making of 2 tons of hay, which the lambs scarcely touched. Had this allowance not been made, the net profit would have been £6 7s. 6d. instead of £4 7s. 6d. Rape, however, although a relatively inferior crop in this case, easily led the way with a net profit of £9 0s. 6d. from the 2-acre block. On a per-acre basis the results might be expressed thus:—

Peas, £2 6s. 6d. loss per acre.
Rape, £4 10s. 3d. profit per acre.
Chou moellier, £1 18s. 9d. profit per acre.
Lucerne, £2 3s. 9d. profit per acre.

As previously mentioned, the crops had to contend with the worst drought experienced in Marlborough for ten years. For this reason in particular the experimental tests have been important. It is intended to extend these trials over a number of seasons.

WHITE AND SUCKLING CLOVER SEEDLINGS.

HOW TO DISTINGUISH THE TWO SPECIES.

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IN the adult stages white clover (*Trifolium repens*) and suckling-clover (*T. dubium*) are easily differentiated. In their seedling stages, however, they are very similar, and the farmer may have difficulty in deciding whether he has a strike of white or of suckling in his autumn stubbles.

For the purpose of obtaining plants for study, seeds of both species were sown at this College, and their contrasting characters noted at two different stages. The first stage is when the seedling has produced the first single leaf; the second stage is when the first trifoliate leaves have been produced.

FIRST STAGE—SINGLE LEAF.

The distinguishing characters in the first stage are—

(*a*.) Shape of the leaf: In both clovers the leaf is obtuse and broad at the base. In white clover it tapers to a broad apex (Fig. 1); in suckling-clover there is no taper, the leaf being as broad at the apex as at the base (Fig. 2).

(*b*.) Appearance of the veins: These are clearly seen on the back of the leaf. In white clover the veins are branched at the tips (Fig. 1), while those of suckling-clover are undivided (Fig. 2).

(*c*.) Margin of the leaf: The margin of the white-clover leaf is notched at the veins (Fig. 1); the margin of suckling-clover is entire (Fig. 2).

(*d*.) Stipules: These are a pair of expansions at the base of the leaf-stalk, where they embrace the stem and its growing-point. The shape and appearance of the stipules are the most certain distinguishing

character between the two clovers. In white clover the stipules are broad and transparent (Fig. 8); in suckling-clover they are pointed and as green as a leaf (Fig. 9).

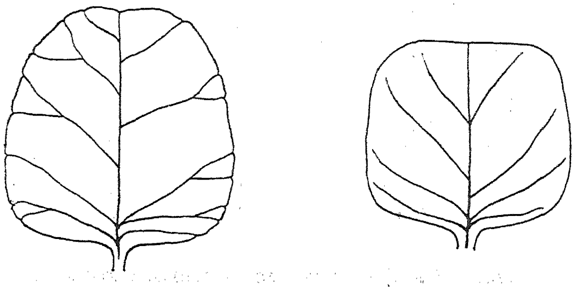


FIG. 1 (LEFT). FIRST SINGLE LEAF OF WHITE CLOVER.
FIG. 2 (RIGHT). FIRST SINGLE LEAF OF SUCKLING-CLOVER.

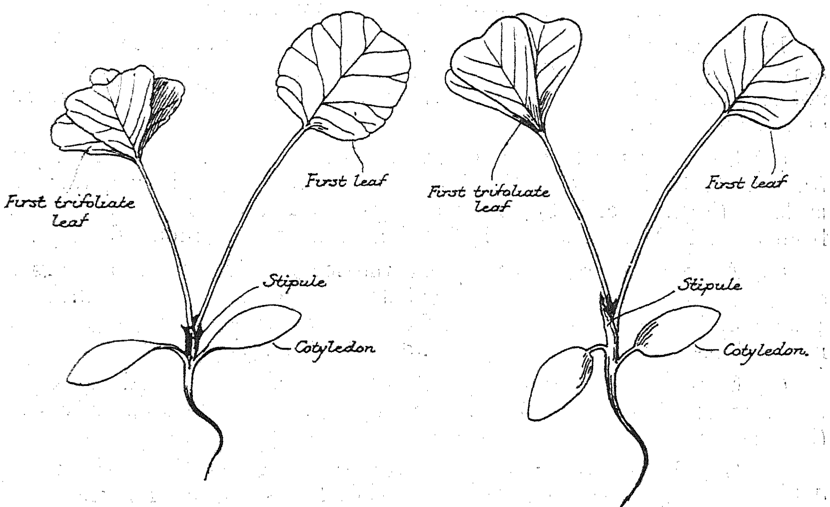
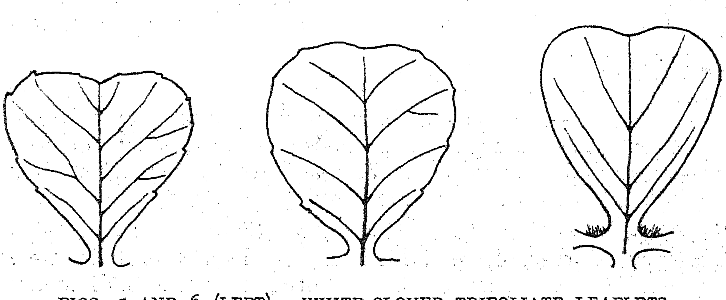
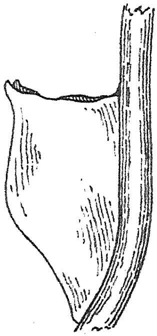


FIG. 3. WHITE-CLOVER SEEDLING. FIG. 4. SUCKLING-CLOVER SEEDLING.



FIGS. 5 AND 6 (LEFT). WHITE-CLOVER TRIFOLIATE LEAFLETS.
FIG. 7 (RIGHT). SUCKLING-CLOVER TRIFOLIATE LEAFLET.



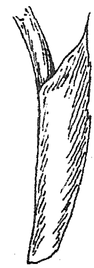


FIG. 8 (LEFT). STIPULES OF WHITE CLOVER.
FIG. 9 (RIGHT). STIPULES OF SUCKLING-CLOVER.

SECOND STAGE—FIRST TRIFOLIATE LEAVES.

In the second stage—that is, when the first trifoliate leaves have appeared (Figs. 3 and 4)—all the preceding differences are still to be noticed, and in addition the following differences between the leaflets of the trifoliate leaves :—

(*a.*) Shape of the leaflet : In white clover there is a short taper from apex to base, and the leaflet is as broad or broader than it is long (Figs. 5 and 6) ; in suckling-clover there is a long taper from apex to base, and the leaf is longer than it is broad (Fig. 7).

(*b.*) Appearance of the veins of the leaflet : The veins are again easily seen on the back of the leaflets. In white clover usually the second and third veins from the base are branched (Figs. 5 and 6) ; in suckling-clover the veins are undivided (Fig. 7).

(*c.*) Margin of the leaflet : White clover has minute teeth opposite the veins (Figs. 5 and 6). The margin of suckling-clover is entire (Fig. 7).

(*d.*) Stipules of the trifoliate leaf : Here again this is the most definite distinguishing character, and is the same as for the first leaf. In white clover the stipules are broad and transparent (Fig. 8), and in suckling-clover they are pointed and green (Fig. 9).

These characters remain constant to differentiate the adult plants, where also the flower and general habit give easy distinguishing features.

SUMMARY.

White Clover.—First leaf obtuse with gradual taper from base to apex, notched margin, branched veins. Leaflet of trifoliate leaves—short taper from apex to base, toothed margin, branched veins. Stipules of all leaves broad and transparent.

Suckling-clover.—First leaf obtuse, as broad at the apex as at the base, entire margin, undivided veins. Leaflet of trifoliate leaves —long taper from apex to base, entire margin, undivided veins. Stipules of all leaves pointed and green.

WINTON AND GORE EXPERIMENTAL AREAS.

NOTES ON OPERATIONS, SEASON 1925–26.

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(1.) Winton Area.

A USEFUL year's operations may be claimed for the Winton Experimental Area in 1925–26. General interest has been evinced in the working of the Area, but the main attraction centred on the various pasture blocks and their treatment. The attendance of farmers throughout the year has been good. Two field-days were held. The first, on 12th February, although wet, was attended by sixty-three persons, and on the second occasion approximately two hundred were present.

During the year a further 10 acres in the new portion of the Area were swamp-ploughed. About half this block was in rushes, &c., and considerable difficulty was experienced in working up the land for the various crops.

The work carried out and results obtained on each block are as follows :—

PASTURE INVESTIGATIONS.

Block 1 was sown in permanent pasture during October, 1925, the seeding being as follows: Timothy, 4 lb.; crested dogstail, 3 lb.; meadow-foxtail, 4 lb.; cocksfoot, 8 lb.; Poa trivialis, 1 lb.; white clover, 1 lb.; red clover, 1 lb.; alsike, 1 lb.; Lotus major, 1 lb. In addition, the area was divided into three equal portions, and meadow-fescue added to the mixture already recorded at the rate of (*a*) 8 lb., (*b*) 16 lb., and (*c*) 24 lb. per acre. It will be noted that perennial rye-grass was not included in this mixture. This experiment is for the purpose of ascertaining how far meadow-fescue may be made use of to replace perennial rye-grass in a permanent pasture under the conditions of this district. Two-thirds of the block were limed with carbonate of lime at 1 ton per acre prior to laying down in grass. Superphosphate, 2 cwt. per acre, was applied at time of sowing. Grazing was commenced on 2nd January last, and the general condition of the pasture is satisfactory.

The treatment and seeding of Block 2 were the same as for Block 1, with the exception that meadow-fescue was replaced by perennial rye-grass in each of the three subdivisions. Grazing was commenced on 4th January last. The carrying-capacity for the period ending 31st March was considerably higher than in the case of Block 1, and the pasture generally is closer. Where only 8 lb. per acre of perennial rye-grass was sown the individual plants appear to be somewhat larger than where 24 lb. was included in the mixture.

Block 3: A special article dealing with the liming and top-dressing experiments on this block appeared in the *Journal* for April last. The carrying-capacity was nearly five sheep per acre per annum, and in addition to this a crop of hay to the value of £4 was sold off the block. The amount received for grazing was £19 15s. 2d. for the year.

Block 4 is a permanent pasture which in point of carrying-capacity and general condition would be hard to excel. It was laid down in

1920, and has been top-dressed twice with basic slag at 3 cwt. per acre. The carrying-capacity for the past season was nearly eight sheep per acre per annum, and would have been greater if more stock had been available towards the end of the year. In connection with operations on this block an account was kept of the expenditure on rent, fertilizers, labour, &c., the total amounting to £14 12s. The income from grazing amounted to £27 0s. 1d., equivalent to a net return of £2 9s. 7d. per acre.

A temporary pasture, containing a certain amount of perennial rye-grass, was sown towards the end of 1923 on Block 5. The amount of grazing afforded by this area during the year has been small. It actually carried 1·8 sheep per acre per annum, and when rent and labour charges are taken into consideration it shows a heavy loss, as the grazing revenue was only £3 16s. 10d. This was a splendid illustration of the kind of pasture not to have, and it served its purpose well. Although a losing proposition, it was of great value in drawing the attention of farmers to the futility of expecting good returns from run-out pastures.

Rates of seeding: On Block 6 there are five 1-acre areas sown with various clovers, with the addition of perennial rye-grass at 10 lb., 20 lb., 30 lb., 40 lb., and 50 lb. per acre. The experiment was laid down to determine a suitable sowing per acre of perennial rye-grass. The 20 lb. and 30 lb. per acre sowings have proved the most desirable in so far as this block is concerned. In the case of the 10 lb. per acre sowing the plants are rather large and coarse in the height of the growing season, while in the 40 lb. and 50 lb. per acre sowings there has been a considerable death-rate, and it is doubtful if either of these areas now show more plants per square yard than where only 30 lb. was sown. In 1924 this block was top-dressed with Nauru rock phosphate at 3 cwt. per acre, two control areas being left for comparison purposes. No increase was obtained from the application of the phosphate. It was therefore decided not to top-dress in 1925, but to make careful observations during the 1925–26 season to determine whether any results were forthcoming from the treatment of 1924. None was obtained, however, the growth being as good on the controls as on the Nauru treatment, and the sheep did not show any preference. The whole of this block has been limed with carbonate of lime at 2 tons per acre. The carrying-capacity was slightly over three sheep per acre per annum, and the grazing revenue was £11 18s. 4d. This does not balance the expenditure when rental, harrowing of pasture, &c., are taken into consideration. The manurial treatment for the 1926–27 season will consist of superphosphate on half and basic slag on the other half, and interesting comparisons are looked for.

OATS VARIETY TRIAL.

Areas of 1 acre each of five varieties were sown on Block 8. The manurial treatment was 2 cwt. superphosphate per acre. The varieties and yields per acre were as follows: Captain, 44 bushels; New Abundance, 75 bushels; Providence, 70 bushels; Black Supreme, 54 bushels; Crown, 73 bushels.

SUNDRY CROPS.

Oats and tares: This crop was sown on Block 9 in October at 1½ bushels of seed for each constituent. An area of 1 acre on this

block had not been limed, and it was noticeable that the tares were much less vigorous on this part; the development of seed was so poor that the block was cut for hay, while the other portion was allowed to go for a seed crop. Weights taken early in the year gave on the limed portion 8½ tons green material per acre, while on the unlimed part the green weight was 5 tons per acre. This was a very weedy block, but the strong growth of tares has smothered most weeds and left a clean stubble.

Block 10 was sown in May, 1925, in Emerald rye-corn, and gave a large amount of spring and summer grazing. It was ploughed in January last, and in February was limed with 1 ton of carbonate of lime per acre, then sown in (1) oats and winter vetches, (2) oats and Moumahaki vetches, and (3) oats and Lathyrus tingitanus for seed-production purposes—also as a smother crop, this area being badly overrun with Californian thistle. The fertilizer used was super, 2 cwt. per acre.

On Block 13 areas of 8 acres in Black Supreme oats for chaff and 2 acres in oats and Partridge peas for hay were grown. The land was not in very good order, and considerable further work, such as drainage and liming, will have to be undertaken. The yield of chaff was 30 cwt. per acre, and 30 cwt. of hay per acre from the peas and oats.

Block 7 was sown in what would have been a very important manurial experiment with soft turnips, but the turnip-beetle took practically 80 per cent. of the young plants, so that no information was forthcoming this year.

ROOT AND FORAGE CROPS MANURIAL TRIAL.

Information with regard to results of the manurial treatment of the various crops in Block 14 (10 acres) has been keenly sought. The results are interesting, and indicate that nitrogen is of economic importance in the case of crops like chou moellier, Thousand-headed kale, and cabbage. In the case of both turnips and swedes the weight of roots per acre was not influenced to any extent, although the top growth certainly was. In the case of Yellow Tankard turnips, Seychelles Islands phosphate, at 3 cwt. per acre, was tried against a complete manure, and proved superior in this test by over 2 tons per acre. In the swede area the addition of potash salts gave on the whole a better crop, and this was verified in the weighing.

The treatments per acre were as follows: (1.) Super, 1½ cwt.; Nauru phosphate, 1 cwt. (2.) Super, 1½ cwt.; 30-per-cent. potash, ¾ cwt.; Nauru phosphate, 1 cwt. (3.) Super, 1½ cwt.; Nauru phosphate, 1 cwt.; 30-per-cent. potash, ¾ cwt.; blood, ½ cwt.

The results of the weighing in each case were as follows, the manurial treatment being indicated by numbers as shown above:—

Superlative swede ..	(1) 35 tons;	(2) 38·4 tons;	(3) 36 tons,
Chou moellier ..	(1) 26·8 ,,	(2) 28·6 ,,	(3) 34 ,,
Thousand-headed kale	(1) 15·6 ,,	(2) 19·5 ,,	(3) 27·2 ,,
Drumhead cabbage	(1) 14·9 ,,	(2) 16·0 ,,	(3) 21·3 ,,

Acknowledgment is due to Mr. T. N. Pattinson, Overseer of the Area, for the interest and care taken by him in carrying out the farm operations, which contributed greatly to the success of the undertaking.

(2.) Gore Area.

The Gore Area is now largely devoted to fertilizer tests and experiments for the purpose of overcoming diseases of turnips, swedes, and potatoes. Interim results in most cases have been highly satisfactory, but considerable time must elapse before all the experiments can reach finality. In the coming season work on the eradication of smut in oats by means of the hot-water treatment will also be undertaken.

A large number of farmers have visited the Area during the year, and the field-day held in February last was attended by over one hundred, notwithstanding wet weather.

DISEASES OF TURNIPS AND SWEDES.

Trial of Disease-resistant Turnip (Block 1).—The variety tested was Irvine's Green-top Yellow Disease-resistant, sown with a commercial Green-top Yellow turnip as a control. This block had carried a turnip crop in the preceding year. Seeding in the past season was at the rate of 1 lb per acre, and the crop was sown on 16th November. Twenty-four drills were manured with superphosphate at 2 cwt. per acre, plus 1 cwt. per acre of 30-per-cent. potash salts. The remainder of the area received super only, at 2 cwt. per acre. Irvine's Disease-resistant turnip showed a more robust growth than the commercial line throughout the growing-period, and the addition of potash gave a better growth than super alone. The turnips were weighed and examined on 11th May, with the following result:—

Variety.	Manurial Treatment.	Cost of Fertilizers per Acre.	Number of Turnips examined.	Number diseased. Dry-rot.	Number diseased. Club-root.	Percentage of Infection.	Yield per Acre.
		s. d.					Tons.
Irvine's Disease-resistant	2 cwt. super ..	13 6	377	1	228	60·7	15·77
Commercial ..	2 cwt. super ..	13 6	376	1	300	80·0	14·68
Irvine's Disease-resistant	2 cwt. super, 1 cwt. 30-per-cent. potash	21 0	345	Nil	245	71·0	18·49
Commercial ..	2 cwt. super, 1 cwt. 30-per-cent. potash	21 0	350	Nil	311	88·8	15·50

Disease-resistant Swedes.—Block 2 was used for a trial of disease-resistant swedes — Irvine's Disease-resistant Purple-top, Springwood, Wiboltt's Purple-top, and Studsgaard—with a purple-top commercial swede as a control.

A manurial trial was also worked into the experiment, the different manures being as follows: A — Superphosphate, 2 cwt. per acre. B—Super, 2 cwt.; 30-per-cent. potash, 1 cwt. per acre. C—Super, 2 cwt.; 30-per-cent. potash, 1 cwt.; dried blood, ½ cwt. per acre. Throughout the experiment the turnips in the drills dressed with superphosphate alone were through the ground several days ahead of

the other treatments, and suffered rather severely from an attack of the turnip-beetle. Treatments B and C both showed a much better top growth, especially in the case of C. In weights per acre, however, the respective treatments did not show much difference in any one variety, except in the case of Studsgaard, where the complete manure gave a greatly increased yield.

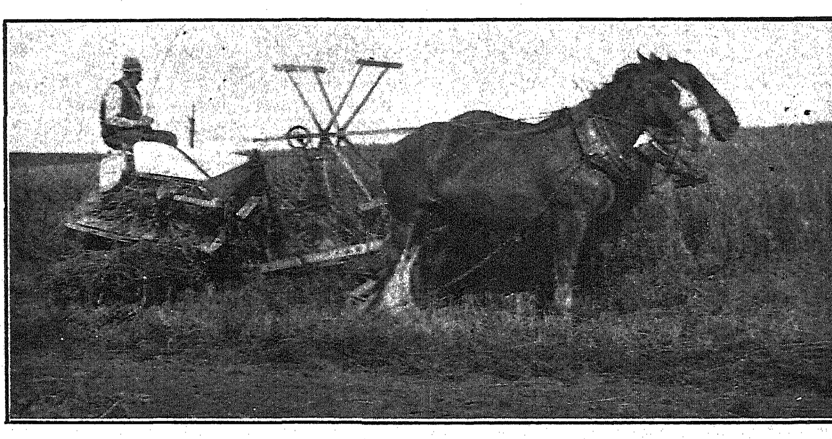
As regards disease, Springwood Purple-top showed the greatest degree of infection and Studsgaard the least among the varieties claimed to be immune. The commercial line weighed up very well, but was practically all infected with club-root, while in Studsgaard the average infection was only 14·5 per cent.

Hot-water Treatment of Seed.—On part of Block 9 two small but very interesting areas of swedes were also accommodated. The block was in swedes last year, and the roots were very badly affected with dry-rot. Each area consisted of four drills 6 chains long. The same variety of seed was used throughout the experiment, but area A was sown with untreated seed, while that for area B was given the hot-water treatment by Mr. J. C. Neill, Field Mycologist, for control of dry-rot. Germination was quicker and better in the case of treated seed. All roots were examined on 14th May. In the case of area A many of the bulbs were in such an advanced state of decay that examination was difficult and in many cases impossible. The result of the examination was as follows :—

	Number of Roots examined.	Number showing Dry-rot.	Percentage of Infection.
Area A	312	47	15·0
Area B	610	1	0·1

OATS AND SCOTCH TARES FOR SEED (BLOCK 3).

This crop was sown on 9th November at the rate of 1 bushel of oats and 2 bushels of tares per acre, with 2 cwt. super, for the purpose of obtaining seed. The growth was exceptionally good, but a heavy storm in January caused the crop to lodge badly, and difficulty was experienced in harvesting. This block was rather badly infested with weeds, but is now in a clean condition, the growth of tares being so strong that all weeds were completely smothered.



CUTTING OATS AND TARES, GORE EXPERIMENTAL AREA.

OATS AND PEAS FOR HAY (BLOCK 4).

This crop was sown on 9th October with 1½ bushels Crown oats and 1½ bushels Partridge peas per acre; fertilizer used, basic super at 2 cwt. per acre. The oats came away well, but the grass-grub took a fairly heavy toll of the peas. The yield of hay was 2 tons per acre. In the adjoining block of oats and tares the grub was present, but no damage was done to the tares.

KALES.

Thousand-headed Kale (Block 6).—This crop was sown on 24th November, the fertilizer used being basic super at 2 cwt. per acre. The growth was very even throughout, and the crop yielded 15 tons per acre.

Chou Moellier Manurial Trial (Blocks 7 and 8).—This experiment created much interest. The growth in the case of the complete manure was very good, and the plants were of a darker colour. The crop was weighed on 11th May, with the following results: 2 cwt. basic super, 18·11 tons per acre; 2 cwt. super, 16·5 tons; 2 cwt. super, ½ cwt. 30-per-cent. potash salts, and ½ cwt. dried blood, 20 tons.

PASTURE LIMING AND TOP-DRESSING.

Pasture Block 8A, laid down in 1923, was an unsatisfactory area, and it was decided to lime and top-dress with superphosphate at the rate of 2 cwt. per acre. The treatment completely transformed the pasture from a poor open sward with considerable ingress of weeds to a very fine pasture which almost completely covered the soil, and with an abundance of white clover. This was a remarkable demonstration of what top-dressing can accomplish in the way of pasture-improvement.

POTATOES (BLOCK 8B).

Pure Seed.—An area of 1¼ acres was planted with Up-to-Date potatoes for the purpose of obtaining a pure line of seed for future use. A quantity of seed was procured in the open market. The variety was supposed to be Up-to-Date, but it proved an impure line, and when the growing crop was rogued about half the plants had to be removed. Other seed was procured at Gore and proved satisfactory. This line was rogued during growth, and the seed is now, as far as can be seen, absolutely pure.

Control of Corticium Disease.—Another part of this block was laid out in experimental treatments having for their object the control of corticium disease. The variety used was Arran Chief, obtained from a line grown on the Gore Area last year; the seed was very badly affected with corticium. The work was carried out under the direction of Mr. J. C. Neill. The treatment consisted of soaking the tubers in a mercuric chloride and hydrochloric-acid solution of various strengths and for varying periods of time. During April Mr. G. H. Cunningham, Mycologist, and Mr. Neill visited the area and made a detailed examination of the tubers from the various plots. Later the potatoes were subjected to a further examination. The various treatments, when weights of plots were compared, showed very encouraging results. For instance, in the treatment with mercuric chloride (1 c.c.), hydrochloric

acid (10 c.c.), and water (500 c.c.), 90 per cent. of the tubers by weight were absolutely free from the disease, while in the controls on either side only 1·6 per cent. were free. Further experiments will be undertaken next season.

MANGOLD MANURIAL AND VARIETY TRIAL (BLOCK 9).

For this test the seed was sown on 9th November, and the crop was weighed on 14th May. The varieties and weights per acre manured with (1) 2 cwt. superphosphate per acre, and (2) 2 cwt. super, 1 cwt. dried blood, and 1 cwt. 30-per-cent. potash salts, were as follows: Wiboltt's Diana Ovoid Giant—(1) 16·2 tons, (2) 23·1 tons; Wiboltt's Studstrop—(1) 15·3 tons, (2) 28·4 tons; Sutton's Long Red—(1) 22·7 tons, (2) 28·2 tons; Wiboltt's Taaroje—(1) 21·3 tons, (2) 31·1 tons per acre.

On the manurial side of the experiment, in all cases the complete manures easily outdistanced the superphosphate controls. The crop was somewhat late in being sown, otherwise the weights per acre would have been greater. The quality of all varieties was good.

CLOVER VARIETY TRIAL (BLOCK 9A).

This trial—laid down in December, 1923—has proved of special interest to many visitors. It is unfortunate that almost the whole block has been so severely attacked by grass-grub that both grass and clover plants have been practically destroyed. The varieties tested were Dutch white, English wild white, and New Zealand white. The Dutch white was the best in point of growth the first year, but disappeared altogether last winter. The wild white was thickening up wonderfully, and the New Zealand white was also making good headway, until attacked by the grub. There was more winter growth on the wild white than on the other plots. The wild white was also a smaller plant, with smaller and darker foliage, and was later in flowering than the other varieties. The New Zealand white was very similar in habit of growth, but was a larger plant in every way.

LUCERNE.

The stand of 1 acre (Block 1A) was dressed with ½ ton of carbonate of lime during the winter. The growth this past season has been very good. Two hay crops were taken, and the third growth eaten off with sheep. The amount of hay obtained amounted to 1¾ tons, and the last growth was equal to ½ ton, making a total of 2¼ tons hay per acre.

Acknowledgment is made of the good work done during the year by Mr. James Sleeman, Overseer of the Area, who has exercised the great care, patience, and exactitude required in operations of the kind here recorded.

Phosphate on grassland encourages clovers; clovers build up fertility; and fertility means increased grass-growth. Apart from increased yield, top-dressed grass increases in palatability.

HISTORY OF CHEWINGS FESCUE.

ADDITIONAL INFORMATION.

IN an article on Chewings fescue published in the *Journal* for December last the writer gave a brief account of the history of the plant in New Zealand. Since then two correspondents have forwarded additional particulars as to the original saving and commercializing of the seed. An Auckland correspondent writes:—

Chewings fescue was practically discovered by the late W. F. D. Rich, of Okoroire, manager of the Thames Valley Land Company, whose estates were on pumice soil which was then too light and loose to grow the cocksfoot and rye-grass then in vogue. When in Southland, and talking the matter over with other farmers, he was advised to see a new grass growing on loose soil on Mr. Chewings's farm. Mr. Rich was well taken with it, and wrote to England to find out what it was, and being told it was hard fescue he ordered several tons through Hesketh and Aitken, then seedsmen in Auckland. But this hard fescue was no more lasting than previous sowings, so he prevailed upon Mr. Chewings to save some of his particular grass. Not knowing what particular fescue it was, he called it "Chewings' fescue." He later wrote frequent articles in the Auckland papers recommending it for pumice soils. He tried too late to get the name changed to "Rich's fescue," and it was catalogued for a time as Rich's or Chewings' fescue . . . I am certain that Mr. Rich was the first to "discover" the grass, in the sense of talking, writing, and popularizing it, and getting it saved commercially . . .

The second correspondent, from Dunedin, states:—

The credit of first having introduced Chewings fescue as a mercantile commodity must be given to the late Mr. G. C. Tothill, of the firm of Tothill, Watson, and Co., who secured the first seed from Mr. Chewings, and expended considerable energy in getting the seed tried in various parts of New Zealand.

Apparently the efforts of both these gentlemen were directed towards establishing the grass throughout New Zealand as a pasture plant, and there is evidence that a fair amount of seed was used in sowing country that has later been shown to give better results with other species. While a certain amount is still used for this purpose, it must be admitted that the special value of the grass lies in its ability to produce lawn turf, and, further, that if it was not for this character the Chewings fescue seed-growing industry would be insignificant.

The credit of establishing the present-day industry should be given to the persons who first recognized the value of the grass as a lawn constituent, and to those who introduced it into North America and Great Britain. —*N. R. Foy, Biological Laboratory, Wellington.*

Adequate feeding of the dairy cow is often neglected, with the result that the return for the food consumed falls below the cost of production and utilization. Inadequate feeding lowers the earning-value of the land.

When cows are in milk the amount of protein they require for efficient production is high. Pasture with abundance of clovers, lucerne, ensilage supplemented with linseed, chou moellier, and turnips contain due percentages of protein.

SEASONAL NOTES.

THE FARM.

PASTURE-MANAGEMENT.

OLD roughage will now be cleared up on the pastures, and spring top-dressing may be commenced during the coming month. In the milder districts there should be a prompt response to quick-acting phosphates. Pastures dressed early in the winter with a slow-acting fertilizer will receive a great fillip if given 1 cwt. of super per acre. Following top-dressing, well-established pastures should be heavily tripod and chain harrowed to scatter winter accumulations of droppings. Vigorous harrowing is next in importance to top-dressing.

Areas intended for hay or ensilage should be well cleaned up in the bottom, and odd bits of fencing-wire, large stones, &c., removed, otherwise valuable time may be lost during hay harvest repairing the mowers. Where the land is available, however—say, after turnips or mangolds—it is often preferable to grow a special crop for hay. Many good pastures are entirely altered and their composition spoiled by being closed for hay. The taller-growing grasses, such as cocksfoot, become very strong, much to the detriment of certain finer grasses, and sometimes the sward becomes very open afterwards, the entrance of weeds and inferior grasses being thereby assisted.

The feeding-out of roots and hay on pasture-paddocks should not be carried so far that pugging or opening of the sward ensues. Weed-invasion tends to follow in this case, and the great growth of Scotch thistle is often due to such treatment.

TILLAGE AND SPRING CROPPING.

Land which is intended for early cropping should be turned over as soon as the soil conditions are favourable. The sod will then be laid bare to the late winter frosts and mellowed to some extent. The early spring rains will also be better conserved, this factor being specially important where the land is intended for root crops. A frequent stirring with the tine harrows or cultivator is of great value in that early spring weed-growth is checked and more surface laid bare to the action of frost and sunshine.

Previously skimmed lea or other land should be ploughed a second time, either towards the end of August or early in September. The root crop suffers too often as a result of only one ploughing, and that late in the season. In a great many cases it would pay handsomely to halve the area, double the cultivation and manure, and intercultivate more thoroughly during the growing season. A poor-yielding mangold crop, for instance, is expensive to produce, but, unfortunately, provides the line of least resistance.

Where the autumn is usually dry and pasture-growth likely to suffer, the dairy-farmer especially should make ample provision of suitable spring-sown fodder, such as chou moellier, soft turnips, oats

and tares, millet, temporary pasture. In scheming out the work ahead it is a wise policy to overestimate the requirements of the stock and underestimate the yield of the crops.

Western Wolths and Italian rye-grass, about 15 lb. of each, with 5 lb. or 6 lb. of cow-grass per acre, sown late in August, makes a quickly grown and very useful temporary pasture, and can also be used later for hay or ensilage if necessary.

Oats and tares on the stronger types of soil, and oats and peas on lighter lands, can with advantage be sown during the latter part of August in milder districts. A dressing of 2 cwt. super or basic super should be applied with the seed, which is usually sown in the proportion of 2 bushels of oats to 1 bushel of peas or tares, per acre.

CEREALS.

Generally speaking, the end of August is quite early enough for sowing spring wheat. For wheat the seed-bed should be worked deeply. The cultivator does better than the disk, as it works the fine soil down and brings the clods to the surface. These afford shelter to the young plants and are later broken down by the roller. In order to make up for the lesser amount of tillering, a heavier seeding than with autumn-sown is required—about 2½ bushels per acre being the usual amount. Superphosphate, from 1 cwt. to 2 cwt. per acre, sown with the seed, is a suitable manure generally.

Oat-sowing can follow sowing of wheat. Early barley may also be sown in August; Cape or Black Skinless will provide useful spring feed for stock. Barley has a weak-rooting system and requires a thorough tilth; the seed-bed should be light without being puffy. An average seeding is 2 bushels per acre, and 1 cwt. to 2 cwt. super per acre, according to conditions, may be recommended.

Spring-sown cereals in general are more susceptible to disease than those sown in autumn, and all seed wheat should be pickled to control smuts before sowing.

Where it is intended to carry on an autumn-sown cereal crop for grain, chaff, or hay, the final feeding should in most cases be done by the end of August, exceptions being very strong land where there is a danger of the crop growing too much to straw and lodging. In such situations feeding-off may often be profitably carried on till the end of September. After the final feeding the ground should be given one or two strokes of the tine harrows. This will open the land, scatter the stock-droppings, and greatly hasten subsequent growth. If the crop has not been previously manured and appears somewhat thin or weak, 1 cwt. of super per acre, applied before or during the harrowing, will greatly benefit it, and often mean the difference between a profitable crop and an unprofitable one.

LUCERNE.

Provided weather and soil conditions are favourable, lucerne stands should be well cultivated during August, before growth has commenced. A top-dressing of 2 cwt. super or basic super is advisable if best results are to be expected. In cases where sulphate of potash or 30-per-cent. potash salts have been added the lucerne has often

appeared more vigorous, with greater freedom from leaf-spot and root-fungus.

ARTICHOKES.

Artichokes are valuable as a food for pigs, and have a higher nutritive value than potatoes, but they are not without disadvantages, being often very difficult to entirely eradicate; hence it is wise to utilize odd corners of the farm or set aside a permanent area for the crop. There are two varieties of the Jerusalem artichoke in use — the purple-skinned and the white-skinned. There is little difference between them, but, if anything, the purple-skinned is more in favour. Artichokes thrive in land suited to potatoes—well drained, light, and friable; but fairly poor and gravelly soils are also suitable. The ground requires to be well worked, and deep winter ploughing is advantageous. Being frost-resistant, artichokes can be sown from about the middle of August or in September.

Like potatoes, artichokes are sown only by tubers, in sets about 2 ft. apart in the rows, which should be about 3 ft. apart, and at a depth of about 4 in. From 8 cwt. to 10 cwt. per acre are required, using medium-sized tubers. Large sets often produce so many stems that the crop becomes crowded and poor tubers result. On the other hand, if the seed is small the shoots are liable to be weak and spindly, resulting in a poor crop of small tubers.

The most satisfactory way to utilize artichokes is to allow pigs to forage them. The pigs should not be left on too long, otherwise the crop in the following season may not be as successful as desired. Pigs usually leave many small tubers in the ground, and these do not throw strong plants; but, even so, several successive crops can be grown. The ground should be manured each season, however. After stocking with pigs the only cultivation that is necessary is to replough and keep the surface soil loose and free from weeds until the next growth of the crop is well above ground.

A general fertilizer as for potatoes is required, the amount used varying with the type of soil. The following mixture, applied at the rate of 5 cwt. per acre, is suitable: Super, 2 cwt.; kainit, 2 cwt.; blood-and-bone, 1 cwt. If any farmyard manure is available it should be utilized, and the mixture of artificials altered accordingly.

MISCELLANEOUS.

If feed is scarce it will pay dairy-farmers handsomely to supplement the ordinary grass ration of low-conditioned cows with some concentrate such as crushed oats or linseed-meal. Response to the spring flush of grass will then be prompt—not, as is often the case, several weeks later when the cows have rebuilt their condition. Plenty of salt should be at hand for milking-cows.

After heavy rains the outlets of mole or tile drains should be examined and any obstructions removed. Wet patches over known lines of under-drains may indicate a broken tile or other obstruction.

Among other wet-weather work, stored potatoes should be picked over, and all rotting or diseased tubers removed.

—*Fields Division.*

THE ORCHARD.

FINISH OF PRUNING.

PRUNING should now be pushed on with all possible despatch. Such a reminder is necessary, judging by the fact that it is not unusual to see pruning being done after trees have commenced to shoot. When this takes place it is a sure sign that the sap has commenced to circulate and nature is functioning throughout the tree; therefore any part of the tree removed after this time necessarily removes some of the sap-flow, and the tree receives a check which is detrimental to its growth. If it is not possible to finish all pruning before growth commences, endeavour should be made to get the trees of less vigorous growth and those that move the earliest completed first.

WET-DAY JOBS.

There are many days during the winter when it is not possible to prune, but there is usually no dearth of jobs requiring attention during the slacker part of the year. In view of the approach of the spraying season the spray-pump and engine should be taken down and thoroughly overhauled and cleaned. It is unwise to trust to luck that it will be all right for another season. The fruit-grader requires cleaning up also, and bearings and belts adjusted. Orchard picking-boxes need repairing and renailing, and the orchard implements cleaning and oiling. There is nothing more irritating, after deciding to get on with certain work, than to find that a day or so must be lost to get the necessary repairs effected.

SPRAYING OF STONE-FRUIT TREES.

The necessity of spraying stone-fruit trees with an insecticide must be determined by the condition of the trees. The common pests to be looked for are San Jose scale and red mite. Green aphis may have been prevalent during the preceding season, in which case spraying will be a preventive measure against attack in the coming season, as the eggs will be secreted round and under the bud scales. Red-oil emulsions, at a strength of 1–15, can be used before bud movement on stone-fruit trees, choosing bright sunny days for the work, as the oily mixture will then penetrate better into the cracks and bud scales and likewise smother the insect eggs better. One cannot expect eggs or insects to be destroyed if the spray does not reach them. In bad infestations of San Jose scale it is better to remove all limbs and twigs than trust to the insecticide, as it is almost impossible for even oil sprays to penetrate through the overlapping scales in excessively bad infections. Lime-sulphur may be used at 1–10 in lieu of oil. Some growers prefer to use this, depending on it to act both as an insecticide and fungicide. I favour the oil sprays, followed by bordeaux later, if these pests are to be successfully contended with.

CONTROL OF FUNGOID DISEASES.

As soon as the buds have a tendency to swell, bordeaux should be applied at 8–6–40. If delayed longer the spores of leaf-curl fungus and shothole become active, and the disease will then not be so easi

controlled. This mixture will also control the fungus causing bladder-plum and peach and plum rusts, and will also be of assistance against brown-rot infection. As an aid to the control of the latter all prunings should be picked up and destroyed, as well as mummified fruits that may still remain ungathered. Bordeaux, at 3–4–40, can be applied again at the first sign of pink if the trees are liable to bad attack.

PLOUGHING AND MANURING.

After a fine spell ploughing should be proceeded with where green crops are ready to be turned in. If it is proposed to use phosphatic manures such as basic slag, basic super, bonedust, or a dressing of lime, these can be spread prior to the ploughing. If put in at this time greater benefit to the trees will accrue than if left till later on, especially if the weather sets in dry. Effort should be made to dig round the trees prior to spring-time in order to bury all leaves and rubbish, remembering that black-spot infection largely comes from the fallen leaves.

REWORKING OF UNDESIRABLE VARIETIES.

It will now be obvious to growers that some of the older and more inferior varieties, especially the mid-season sorts, have had their day and will no longer stand transportation charges, &c., and leave a profit. It is difficult, however, to know what to substitute. It would appear to be unwise to work on any more Delicious; there are thousands of trees of this variety yet to come into full bearing. For export purposes Statesman promises well, being a free grower, good cropper, and producing a high percentage of fancy-grade fruit. Golden Delicious is being talked of a good deal, but from recent information gathered from a visitor from America this apple is very variable, according to the locality where grown, and very tender to handle. Thorough trials in each district would appear advisable before heavy reworkings are undertaken.

—*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

Oranges—Poorman and sweet—may be harvested as ready. Preserving-oranges may be picked for market when showing very light yellow. Larger-sized Poormans, intended for use as dessert fruit, should be allowed to become well mature on the trees and attain a uniform deep-yellow colour. Sweet oranges will also be of better dessert quality if left to mature for some time on the trees after they become fully coloured. Lemons should also be picked—if for curing, when sufficient size is attained, though the fruits are of light green to silver colour; if as tree-ripe, when light yellow.

Planting: All kinds of citrus-trees may be planted at this season. The essential factors are: (1) The soil should be in good order at time of planting—that is, not sticky; (2) trees should be planted firmly, but the surface soil left loose; (3) the plants should be supported by a strong stake inclined towards the prevailing wind; (4) the stake (not tree) should be bound with sacking or like material to prevent chafe; (5) long extensions or unshapely growths should be cut back in order to shape the tree and restore balance between top and roots.

Where plantings are being made it will be advisable to plant a tree or so of the newly introduced lemon Meyer, to test as soon as possible its suitability to the location. This variety is extremely hardy and robust, and produces fruit of nice commercial size and of a very refined type. Freshly picked fruits have the appearance of well-cured specimens. Present indications are that this variety will be better worth growing than most others in localities to which it is suited.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

THE HATCHING SEASON.

In a general way August and September are the best months of the year for the hatching of the late autumn and winter layers, though the former month is certainly the best time for chicks of the heavier breeds to be brought out. Chicks produced during this period will meet with those favourable conditions that are necessary for their best development. No young birds do so well as those which make their chief development as the days lengthen. Those hatched out in summer—which must necessarily make their main growth during the waning days — seldom grow to a desired size, nor prove profitable stock as egg-layers. Besides, they never make desirable breeding-specimens. Thus every endeavour should be made to secure the required number of young stock before the correct hatching season passes. To ensure best results in this important work (whether hens or artificial appliances are used) some experience is necessary. Even then failure is inevitable if constant attention to the numerous details involved is not strictly observed.

INCUBATION.

Those who have not had previous experience and are making their first attempt this season to work an incubator would be well advised to follow closely the instructions supplied by the maker. With experience, however, it may be found necessary to amend at least some of these to suit particular local conditions, as no hard-and-fast rule can be laid down that will suit all conditions alike. A few points on this important work, and which will apply generally to all machines, may assist the novice towards securing good hatches. Of course, the basis of successful hatching and rearing operations largely depends on the conditions of the breeding-birds. Unless these are vigorous, properly fed, and kept under conditions that will ensure the maintenance of good health, the best incubator or brooder ever made will fail to produce desirable stock.

Having eggs containing the desired strength of germ, the next important point is the maintenance of an even temperature in the incubator-chamber, about 102° F. for the first week, 103° for the second and third week, and 104° when hatching. By right degree of heat that should be maintained is meant the temperature required by the germ of the egg, which is always floating uppermost irrespective

of the position in which the egg is resting on the tray of the incubator. Thus the necessity of having the bulb of the thermometer resting on the top of a fertile egg will be seen. It is the position of the thermometer which is responsible for the success sometimes claimed by those who work at higher temperatures. For example, if the thermometer is 1 in. or more above the eggs, and therefore nearer the main source of heat, it must necessarily be registering at a different degree of heat from that which the eggs are receiving. For instance, if the bulb of the thermometer is from 1 in. to 1½ in. above the eggs, it would require to register 104° to 105° to make sure of the eggs having the desired temperature. Of course, an incorrect temperature may be secured by the reverse position—the thermometer being too far below the level of the top of the eggs. If the eggs commence to pip on the twentieth day and the hatch is cleaned up on the twenty-first day it may be taken for granted that the thermometer reads correctly, and that the right degree of temperature has been maintained. If the eggs are fresh when placed in the incubator and the thermometer kept on a level with the germs, and the hatch delays, it is well to have the thermometer tested or a new one secured.

Failure of the thermometer to register the correct degree of heat is a common cause of eggs failing to hatch on time and poor results being obtained from incubators. Of course, stale eggs will always take longer to hatch than those that are fresh, and allowance must be made for this. Eggs intended for incubation should be placed under the incubation process as soon after being laid as possible. True, they will often retain their hatching-qualities when a month old or even older, but usually the chicks produced from them are delicate and difficult to rear. Eggs for hatching purposes should also be frequently collected, especially during hot weather, as when several hens follow one another in the same nest the germ is apt to start in the first eggs laid and spoil their chance of hatching when placed in the incubator.

Reverting to the question of temperature, it is important for the incubator to stand on a solid foundation and be perfectly level, otherwise a uniform degree of heat will not be maintained in all parts of the egg-chamber. The incubator should also be placed in a room that is free from draughts, and the temperature of the room should not markedly fluctuate in accordance with outside climatic changes. Especially where a wooden room is used it is a wise course to have it well lined and arranged in such a way that extreme weather conditions may be guarded against. Care must be taken, however, that the room is well ventilated, as fresh air is imperative for best results. Ventilation should be arranged in such a way as to prevent the lamp being in a direct draught. The slightest flicker of the flame is apt to make the lamp smoke, which is a frequent cause of poor hatches and of incubators being destroyed by fire.

Bent connecting-rod: It is a mistake to throw tools, boxes, &c., on the top of an incubator when out of use, as this is apt to cause the screw part of the connecting-rod to become bent. If there is the slightest kink in the connecting-rod the pull from the thermostat will not be direct, and therefore the disk will not rise and fall in complete harmony with the thermostat. If the screw part of a connecting-rod becomes bent it can never be depended upon, and the only safe course

is to take it out and put a new one in its place. Much annoyance and loss through bent connecting-rods would be avoided if during the off season the regulating-apparatus were disconnected and placed inside the machine.

CHICKS DEAD IN SHELL.

The chief problem in incubation that is vexing poultry-keepers to-day is the finding of well-developed chickens dead in the shell at hatching-time. No definite cause can be attributed for this. The breeding-stock may be responsible—for instance, breeding from overfat hens that have insufficient exercise or birds that have been forced for heavy egg-production. Very often on close examination of such eggs there are many things to be observed indicating a probable reason for the failure to hatch. Sometimes the chicks are in such a position that it would be impossible for them to make the natural turn in order to cut their way out, while in other cases they may be so large that they cannot make the necessary movements. Further, it may be found that the air-cell is dried down too far, and that the membrane under the shell is so tough that the chick cannot pierce it, and consequently dies in the shell. In the work of incubation the aim should be to have the air-cell almost one-fourth the size of the egg at pipping-time—in other words, dried down to where a chick would be expected to pip when under natural conditions. Thus the size of the air-cell should govern to a great extent the amount of cooling, ventilation, and moisture required by the eggs during the various stages of the incubation process.

Where it is found that the air-cell is drying down too fast, moisture should be applied to check this, either by putting water in the trays provided or by keeping the floor of the incubator-room in a moist or more or less wet condition. Besides this, the ventilation-space should be reduced. On the other hand, if the air-cell is not coming down to a desired line at, say, about the fourteenth day, and the eggs appear to be more or less clear just under the line of the air-cell, the presence of excessive moisture is usually indicated. In this case the ventilators should be opened wide to allow the moisture to escape. If the cell is considered to be too small, and the egg appears to be dark right up to the membrane enclosing the air-cell, it indicates that the chick is growing too fast, and, if not checked, will be too large at pipping-time to enable it to turn in the shell and get out of its prison. This is probably why the remark is so often heard that the chicks which are found dead in the shell are usually of exceptional size when the eggs are broken. Where it is found that the chick is making too rapid growth the only safe course is to reduce the amount of ventilation and cooling, in order to prevent the developing chick from obtaining too much oxygen and thereby growing to an unnatural size.

Study of the air-cell is thus a matter of vital importance, for upon the operator knowing how and when to apply moisture, cooling, and ventilation depends largely the success or otherwise of the incubator work. The importance will thus be seen of carefully studying the diagrams shown in the usual book of instructions supplied by the makers of incubators as indicating what the condition of the air-cell should be at the various stages of the incubation period.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

PREPARATIONS FOR THE NEW SEASON.

By the end of August the beekeeper should have his preparations for the season's work well in hand. Hive and frame making, also the overhaul of all defective supers, roofs, and bottom-boards, should be undertaken in earnest. It is not wise to postpone the mechanical part of the work in the apiary until the bees themselves require the major portion of one's time. If increase is desirable—more especially where the apiary is being enlarged—ample provision should be made for it. It is most tantalizing to leave a swarm hanging on a tree while a hive has to be hastily put together.

Where the beekeeper does not make his own hives he should now order in sufficient stocks to see him through the coming season. In most cases it does not pay to make one's own appliances. Hive-manufacturing in New Zealand has been brought to a high standard, and unless the beekeeper has ample capital to purchase machinery to turn out good hives he will find the home-made article too costly in the long-run. Whether the beekeeper is working on a small or large scale he should aim at uniformity, and in building up an apiary decide at the beginning on the style of hive and frame he is going to use, and continue on these lines. Non-fitting supers and frames mean extra labour, and lead to endless trouble in the long-run. The hives principally in use in the Dominion are the ten- and twelve-frame Langstroth, and experience of his district will enable the beekeeper to decide as to the best one to adopt. Careful inquiries should be made from beekeepers of long standing in the district as to the best style to use.

A CHEAP FRAME HIVE.

Though there may not be much gained in the long-run by making any other than good substantial hives in the first place (especially by those who can construct their own), there may be those to whom the question of saving a shilling or two upon each hive is a consideration. In such cases the following directions for converting a benzine-case into a frame hive of the same dimensions as the standard Langstroth, and which complies with the Apiaries Act, should be of service:—

Procure a complete and sound case and carefully take it to pieces, then rabbet the ends on one edge to a depth of $\frac{7}{8}$ in. by $\frac{1}{2}$ in. to carry the frames. A tin rabbet should be nailed on the inside, to stand $\frac{1}{4}$ in. above, on which the frames will rest. Now cut the sides so that they measure 20 in. Nail together, and this will give a hive the inside dimensions of which are $18\frac{1}{4}$ in. by $14\frac{1}{4}$ in. by $9\frac{5}{8}$ in. A loose bottom-board may be constructed 24 in. by 15 in. wide. Nail on the board three strips of wood, $\frac{3}{8}$ in. by 1 in., running along two sides and one end, so that when the hive is rested on the bottom-board it will leave an entrance $\frac{3}{8}$ in. deep. Top or surplus boxes can be made in the same way. The best roof to use is a flat one. It may be made from the surplus timber of the benzine-case, and should telescope to a depth of 3 in. over the hive. Cover the top with ruberoid, zinc, or other waterproof material, and let it overlap the edges.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

TOBACCO.

As the tobacco-plant takes about ten weeks to reach a size suitable for planting out in the field, a commencement is made during the month of August to sow down the seed-beds. The extreme fineness of the seed makes it necessary to distribute a small bulk over a comparatively large area. To do this conveniently one of two methods is adopted. Either the seed is mixed with a quantity of sifted wood-ashes, sand, or bone-meal at the rate of ¼ oz. of tobacco-seed to 2 quarts of ashes, and then carefully broadcasted, or it is placed in a can of water, kept carefully agitated, and sprayed on the seed-beds through a fine rose. Seed so fine requires little or no covering of soil: it is merely rolled in with a heavy hand-roller, or pressed in with a board, or trodden in with the feet. After sowing it is often watered in with a can with a fine-rose nozzle.

With a view to gaining a week or two on the season in colder districts some growers sprout the seed before sowing. This is done by sprinkling the seeds on wet flannels and rolling them up. These are immersed daily in hot water and wrung out and kept in a warm place. In about a week a small white shoot appears, and the seed must then be sown. Usually the advantage is hardly worth the trouble.

To provide against the danger of cold snaps and late frost a wooden kerb about 6 in. high is placed round the seed-beds, which are then covered with a hessian cover on a roller. This assists germination by keeping the bed warm and moist. To prevent the canvas touching the bed, stretcher-battens are nailed across the frame at intervals. In colder districts the beds are often made about 4 ft. wide and the frames covered with glass sashes until the plants have made sufficient growth, when they are removed and the cloth used. When the plants are up, air may be given on warm days, at first for short periods only.

Every agricultural product has its own requirements in the way of storage conditions, a careful observation of which well repays the owner. A fair quantity of tobacco-leaf is air-cured successfully in more or less open sheds, but to leave it there after curing, when it is exposed to cold draughts and humid conditions of the winter months, is to seriously discount its value. Tobacco should be stored in a dry, well-ventilated room of a temperature of 50° to 60° F. Unlined corrugated iron on which moisture deposits in cold weather is unsuitable in a building for this purpose.

SMALL-FRUITS.

The planting of berry-fruits should now be completed, pruning the plants hard back with a careful regard in most instances to the arrangement of the new growth of the coming season. Exceptions to this are passion-fruits, the planting of which is best held over till next month; also Cape gooseberries, tomatoes, and peppers, which are not planted out till all chance of a hard frost is past. Most established plantations of berries will benefit from an application of nitrate of soda, 1 oz. to the square yard or 2½ cwt. to the acre, as soon as fruit commences to set. Clean up strawberry-beds that are to be grown on,

giving them a good spraying with bordeaux, 4-4-40, for the control of leaf-spot and other fungous troubles. Give a good dressing of phosphates and potash, and light cultivation. At this season it is specially necessary to call attention again to that old warning against working land when it is in a wet condition. The results are most serious, and cannot be overcome for a long period.

TOMATOES AND CUCUMBERS UNDER GLASS.

The main tomato crop under glass is usually planted out towards the end of August. In preparation a dressing of superphosphate and sulphate of potash may be given ; lime, sulphur, and sulphate of iron are also sometimes added. The latter is a remedy for that yellow abnormal foliage known as chlorosis, which is getting rather too common a trouble. For planting, the soil is best in a firm condition. Houses that have been kept too close and allowed to become very dry should be thoroughly soaked before planting. Plant firmly in furrows of moderate depth and rather wide, watering the plants in. Many plants are seriously chilled in carrying out this operation ; as an early and ample crop is the object, every care should be taken to avoid this. Avoid taking the plants into the open air as far as possible, especially in cold weather, and avoid the use of very cold water. Much has been said about the benefits of ample ventilation of the tomato-house, but such remarks apply chiefly to the period when the plants have grown up and during the summer season. At this season a little top ventilation can be given on bright, warm days until near the middle of the afternoon.

About the same time cucumbers are usually planted out in specially designed glasshouses, and to obtain the warm, moist conditions they require hot-water pipes, or a hot-bed of fermenting materials may be used. In the latter case much will depend on its preparation. It must be turned and mixed about three times, in each case after a high temperature through fermentation has been obtained, each time damping down with water any portions that are dry. It may then be placed in position and watered. Cover the bed with a suitable compost, arranging it in mounds, and when thoroughly warmed through the plants may be put out or seeds sown. The night temperature should not fall below 65° F., and on bright, warm days a little top ventilation may be given until the early afternoon.

OUTDOOR VEGETABLES.

Rhubarb and asparagus beds should now be given a dressing of nitrate of soda, the latter crop receiving a double dose of 5 cwt. per acre.

Plant out main-crop cauliflower and cabbage, lettuce and onion plants, shallots, garlic, artichokes, and early potatoes, and sow the main onion crop (where this method is adopted), spinach, and lettuce (as recommended last month) where this has not already been done.

To this list may now be added the main crop of peas. This crop, with the French beans to be sown later, is an important factor in a satisfactory crop-rotation, and should be given careful consideration

in that respect. They usually follow the root crops, and when well grown are of great assistance in reconditioning the land. Sow also the main crop of parsnips, short-horn carrots, turnip-rooted beet, white turnips, parsley, and cauliflower. A dressing of superphosphate and sulphate of potash before sowing would be good practice in most instances.

POTATOES AND KUMARAS.

The main-crop seed potatoes are usually too bulky to sprout in trays as the early varieties are often treated, but care is needed now to see they do not sprout in the sacks. They should be kept in a light sunny place and turned occasionally; also piling of the sacks refrained from.

In many parts of the Dominion main-crop potatoes often suffer badly from blights, and there is considerable interest being taken in the sweet potato, or Maori kumara, which is comparatively free from such troubles. Growers who have a moist, loose soil in a sheltered locality might well give this crop a trial. To obtain plants a hot-bed of 1 ft. or so in height should be formed in a warm, sheltered place during the month of August, and on it a board frame placed in position. Cover the enclosed portion with 2 in. or 3 in. of sandy soil. When it has become thoroughly warm, place on it the tubers close together, but not touching. Sift in the sandy soil and cover the tubers to a depth of 4 in. or 5 in. Keep the bed moist, but not wet, and in frosty weather cover with a good hessian cloth. In a few weeks the tubers will sprout, and when the growth is about 6 in. long the sprouts should be carefully removed and heeled in a sheltered place to callous and harden off before putting them out into a permanent position. Varieties that have done well here are Red and White Bermuda, Porto Rico, Nancy Hall, and Southern Queen.

TREES AND SHRUBS.

The planting of trees and shrubs should now be completed as soon as weather and the condition of the soil permit, care being taken to securely fence them from the reach of stock. Many shelter plantations are foul with gorse, bracken, and dead timber. The destruction caused by fire in recent years is a serious warning that such conditions should not be allowed to continue. If this rubbish is cleaned up and piled in the open and burnt, and the ashes spread, the danger will be averted and the land will benefit.

GRASS-GRUB IN PLAYING-GREENS.

Inquiries have been received regarding damage to playing-greens from the attacks of the grass-grub. On light land in dry weather this pest is often a serious problem. Methods will doubtless be discovered of destroying the pest on small areas by means of fumigation, but up to the present little success has been achieved in this way. Lawns on such land would receive great benefit from frequent rolling when it is in a moist condition. They should also be given now a generous top-dressing of soil and manures to encourage a strong growth of turf.

—*W. C. Hyde, Horticulturist.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COUGHING AMONG SHEEP.

"R.," Bay of Islands :—

For the last two years I have noticed several of my stud sheep coughing at this season. It cannot be caused by cold, as they commence during the autumn while the weather is quite warm. Is it likely to cause rupture, and can you suggest a cure or preventive? The coughing leaves them in the spring without having pulled them down in condition.

The Live-stock Division :—

The coughing is not likely to cause rupture. The cause of the coughing is probably the common lung-worm, which sets up an irritating bronchitis. Feeding on low-lying or wet pastures is a contributory cause of the parasitic infestation, because such areas are conducive to the life and propagation of these worms. Good well-drained paddocks should be provided for sheep if they are inclined to harbour parasites, also a daily ration of nutritious food, such as crushed oats and good hay. For the sheep which are severely affected a drench of two teaspoonfuls of turpentine (for lambs, one teaspoonful) given in a large cup of milk two or three times at intervals of two or three days is recommended.

GRASSES FOR SWAMP AREA.

I. B. CRUICKSHANK, Otewa :—

I should be obliged if you would tell me if it is possible to procure in New Zealand plants of Poa aquatica. Do you think it advisable to plant it in a small raupo swamp for grazing dairy cows?

The Fields Division :—

Poa aquatica is a decidedly inferior grass, being coarse and unpalatable. However, it makes very fair rough feed which stock will make use of in seasons of scarcity. Plants may be obtained from most seedsmen. A far better grass is Glyceria fluitans (floating sweet-grass), but apparently there are no regular supplies of this. It might be possible for you to obtain plants locally. Without knowing the possibilities of your swamp it is difficult to advise you further. Presumably it is too wet to grow such plants as alsike, clover, Lotus major, Yorkshire fog, and timothy. These are very much better feed than Poa aquatica.

FEEDING MANGOLDS TO POULTRY.

"INTERESTED," Upper Hutt :—

Kindly advise me whether mangolds for feeding to poultry may with advantage be fed directly when pulled, or whether they should be pitted to allow for them ripening, as is recommended when feeding to cattle?

The Live-stock Division :—

It is always a wise course to pit mangolds for some time before feeding them to poultry. Especially does this apply to districts that are subject to heavy frosts.

MELONS FOR PIG-FOOD.

"SUBSCRIBER," Dargaville :—

Could you kindly advise me of the value of pie-melons for pig-food during winter, and also whether to feed them boiled or raw?

The Live-stock Division :—

Pie-melons and other gourds of a similar nature all make good pig-food, but are not sufficient in themselves owing to their low feed value, and should be supplemented during the winter months by grains or meals. Foods of a more nourishing nature, such as artichokes or chou moellier, can be more readily grown and have a much higher feed value. There is no need to cook the melons; they are best fed raw.

NON-FRUITING OF CHERRY-TREES.

G. J. DUXFIELD, Matamata :—

I have two cherry-trees that blossom every year but do not fruit. The fruit forms, but drops off when about the size of peas. The trees have been planted about fifteen years. Can you recommend any treatment?

The Horticulture Division :—

The reason for your cherry-trees not setting fruit may be any one of a number of causes, such as disease, wrong cultural methods, frosts, unsuitable weather at the time of flowering, general debility, or (perhaps what is most likely) want of interpollination with another variety. The practice of planting blocks of trees of one variety has revealed the fact that many kinds and varieties will not set a crop unless associated with other varieties which flower at the same period. The point could be tested by obtaining cherry-blossom of another variety and placing it in a tin of water beside your trees when they are in bloom.

GRASSES FOR BAY OF PLENTY SANDY COASTAL LAND.

F.W.N., Thornton :—

I have poor, sandy, coastal land—ploughable, but only suitable for sheep and dry cattle. I expect to be sowing some down to grass this coming spring, and was thinking of including some tall fescue in the mixture. To give you an indication of what class of land it is, the main grasses will be brown-top, paspalum, Danthonia pilosa, and some crested dogstail, with clover. Any advice regarding the fescue will be appreciated.

The Fields Division :—

From knowledge of your district we would advise you not to grow tall fescue on the sandy coastal land. As you intend sowing in the spring your best plan would be to aim at a paspalum-clover pasture. We would advise a mixture somewhat as follows: Perennial rye-grass, 8 lb.; Italian rye-grass, 3 lb.; paspalum (at least 40 per cent. germination), 12 lb. to 14 lb.; brown-top, ½ lb.; crested dogstail, 2 lb.; white clover, 2 lb.; red clover, 3 lb. Sow the mixture with 2 cwt. of superphosphate and 1 cwt. of blood-and-bone per acre.

MAINTENANCE OF BREEDING-SOWS.

J. BREMNER, Kokako :—

Next season I am contemplating the keeping of several breeding-sows in conjunction with the dairy herd, from which I expect to have left over, from September to March, 40 gallons of skim-milk daily. Towards the end of the season the milk would be supplemented and afterwards replaced by artichokes, pumpkins, &c. Providing the sows are allowed free access to water and good paspalum pasture, and that the litters are sold as weaners, how many sows should I keep—all farrowing during August and September? Would you recommend feeding to them the boiled-down carcases of calves?

The Live-stock Division :—

If you make provision for plenty of winter and early spring feed, such as artichokes, rape, mangolds, and chou moellier, you should be able to maintain

ten breeding-sows throughout the year under the system you suggest. You can use to advantage the meat and liquid from boiled calves, but the sows should not get too much, especially when the young pigs are suckling, as the meat is of a highly nitrogenous nature and can easily upset the sow. On this account the young pigs will suffer too. It is advisable when giving food of this nature to add some grains or meals so as to balance the ration.

IRISH BLIGHT IN STORED POTATOES.

"POTATO-DIGGER," Ashburton :—

Can you tell me (1) if there is any method of detecting Irish blight in potatoes; (2) whether if blighted potatoes are stored with clean ones the blight will spread to them also; (3) if there is any method of killing the blight at this stage in potatoes that are going to be used for seed?

The Fields Division :—

Irish blight may be detected in potato-tubers by the appearance of small depressed areas in the skin, accompanied by discoloured patches in the flesh beneath the depressions. These discoloured areas, as a rule, do not penetrate deeper than ¼ in. to ½ in., but in severe cases of infection the greater part of the tuber may be infected. Severe infection is usually followed by decay of the tuber. The disease may spread from diseased to healthy tubers, especially when stored under moist conditions. There is no method in use whereby the disease may be destroyed without injury to the tuber. We recommend greening of tubers prior to planting, as the diseased tubers become noticeable and may be removed. By careful selection it is possible to eliminate most if not all diseased tubers in a lot required for seed.

FOOT-ROT IN BULL.

"LUCERNE," Waharoa :—

I have a pedigree bull that has had what is commonly called foot-rot—swelling and discharge between the two parts of the foot. I washed it daily with lysol and hot water, and applied Stockholm tar. The foot healed up, and the swelling was reduced, but there is still slight swelling and lameness. Can you suggest a complete cure?

The Live-stock Division :—

The treatment you adopted was quite a good one, and it has been successful in healing the wound. Some time may now elapse before all lameness and swelling disappear—indeed, such is quite the course to be expected. In order to reduce these two troubles we would advise applying a blister to the swollen part around the head of the hoof, taking care that a slough is not caused in the heel where the skin is thin. This treatment may be repeated, if necessary, two or three times. Undoubtedly, the underlying tissues of the foot have been detrimentally affected, and will need time to become restored to the normal.

BLUESTONE AND MUSTARD DRENCH FOR SHEEP.

J. C. SCHENCK, Ormondville :—

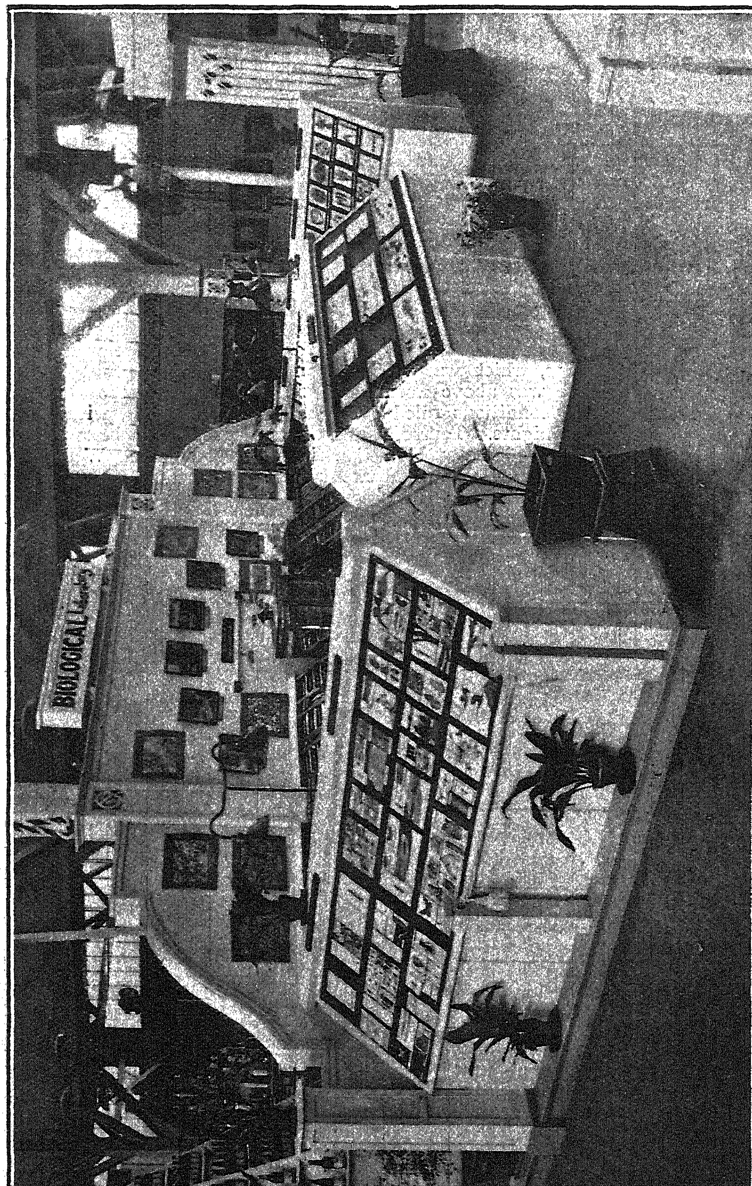
Can you give me the formula for bluestone and mustard for dosing lambs and sheep—quantity and strength in each case?

The Live-stock Division :—

For this drench 2 oz. of bluestone is dissolved in 1 gallon of water. Of this solution the dose for a sheep is 3 oz., and half that quantity is the dose for a lamb. It is doubtful if the addition of mustard has any beneficial effect, but it can be added in the same quantity as the bluestone.

SOME AGRICULTURE DEPARTMENT EXHIBITS AT NEW ZEALAND AND SOUTH SEAS EXHIBITION, DUNEDIN, 1925-26.

WOOL AND WOOL TEXTILE EXHIBIT.



BIOLOGICAL LABORATORY EXHIBIT.

[*Photos by H. Drake.*

WEATHER RECORDS: JUNE, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

RAINFALL in June was below the average in most parts of the Dominion, but northward of Auckland and Thames it was from 10 to 58 per cent. above the average. In the South Island the records from Hanmer Springs, Arthur's Pass, and Queenstown show total rainfalls above the average for the month in previous years; all other places record a deficiency from 10 to 80 per cent.

There were two ex-tropical disturbances, with their lowest pressures passing on the 3rd and 30th, which accounted for heavy rainfall in the far North. An intense westerly disturbance passing between the 11th and 16th brought high north-westerly to south-westerly winds and squally conditions, particularly in and southward of Cook Strait. At this time also there was some snow on the higher levels in the South Island and southern parts of the North Island. Otago and Southland, however, escaped storm effects, and the weather in these districts was, as frequently occurs there in winter, remarkable for its mildness. Local observers report that grass showed signs of growth, and that there was also a second growth of turnips, which was very welcome to the farmers.

Barometric pressure was above normal, particularly between the 16th and 27th, when anticyclonic conditions ruled over the whole Dominion, with bright sunny days and frosty nights. Temperatures on the grass went below 32° F. (freezing-point) on thirteen nights at Hokitika, fifteen at Napier and Wellington, twenty-four at Masterton and Nelson, and twenty-six at Christchurch. ("Ground frosts" are counted below 30° F.) The range of temperature over the Dominion was rather larger than usual, and the weather, on the whole, cool and fair, with little wind.

RAINFALL FOR JUNE, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	5·94	15	0·98	5·53
Russell	8·14	13	2·72	6·28
Whangarei	8·83	14	5·12	5·26
Auckland	5·42	15	1·44	4·91
Hamilton	4·43	16	1·08	5·07
Kawhia	3·32	14	0·92	5·46
New Plymouth	3·08	15	1·06	6·20
Riversdale, Inglewood	5·67	12	2·16	10·31
Whangamomona	4·97	8	1·40	7·92
Tairua, Thames	8·14	13	2·14	6·95
Tauranga	3·58	10	0·93	5·42
Maraehako Station, Opotiki	5·82	11	2·58	5·68
Gisborne	2·07	14	0·56	5·28
Taupo	3·47	6	0·87	4·35
Napier	0·94	12	0·17	3·59
Maraekakaho Station, Hastings	0·69	14	0·18	3·33
Taihape	1·58	10	0·46	3·85
Masterton	1·46	13	0·46	3·48
Patea..	1·85	12	0·50	4·40
Wanganui	1·42	3	1·00	3·29
Foxton	2·76	10	0·88	2·83
Wellington	2·86	12	0·87	4·90
South Island.				
Westport	3·69	11	0·75	7·53
Greymouth	5·27	11	1·39	8·99
Hokitika	7·44	12	1·73	9·60
Ross ..	5·87	7	1·11	9·20

RAINFALL FOR JUNE, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Arthur's Pass	10·71	9	5·02	9·77
Okuru, Westland	8·76	9	2·75	10·76
Collingwood	8·59	10	3·16	11·33
Nelson	1·96	7	0·78	3·69
Spring Creek, Blenheim	1·19	6	0·45	3·23
Tophouse	4·39	9	0·85	4·99
Hanmer Springs	4·20	15	1·10	3·05
Highfield, Waiau	1·59	8	0·47	2·50
Gore Bay	0·59	5	0·33	2·30
Christchurch	0·90	10	0·34	2·66
Timaru	1·10	7	0·58	1·70
Lambrook Station, Fairlie ..	1·52	7	0·50	2·06
Benmore Station, Clearburn ..	1·86	10	1·10	2·06
Oamaru	1·26	9	0·42	2·01
Queenstown	3·06	8	1·16	2·41
Clyde	0·62	6	0·26	0·98
Dunedin	2·83	14	1·10	3·15
Wendon	1·61	10	0·60	2·71
Gore	2·08	14	0·79	2·95
Invercargil	3·23	18	1·20	3·60
Puysegur Point	5·82	20	1·28	6·58

—*D. C. Bates, Director.*

DAIRY FACTORIES IN NEW ZEALAND, 1926.

THE following table presents the registrations of factories under the Dairy Industry Act as at 30th April last, together with the quantities of butter and cheese forwarded to grading-stores for export during the year ended 31st March, 1926, and the numbers of milk or cream suppliers to the factories:—

District.	Number of Factories.				Forwarded for Export, 1925–26.		Number of Suppliers to Factories.	
	Butter.	Cheese.	Dual Plant.	Total.	Butter.	Cheese.	Butter.	Cheese and Dual Plant.
					Tons.	Tons.		
Auckland ..	65	35	6	106	37,947	10,785	16,417	1,255
Taranaki ..	20	73	37	130	7,736	31,953	3,150	3,397
Wellington ..	18	51	10	79	6,931	11,852	4,551	1,671
Hawke's Bay ..	14	16	3	33	2,629	3,146	3,775	554
Nelson	6	4	1	11	1,052	499	1,144	444
Marlborough ..	4	2	4	10	676	718	769	212
Westland ..	9	..	1	10	487	73	709	32
Canterbury ..	9	12	5	26	1,933	1,589	4,816	2,393
Otago and Southland	14	78	1	93	1,804	11,067	6,552	2,764
Totals, 1926 ..	159	271	68	498	61,195	71,682	41,883	12,722
Totals, 1925 ..	156	267	69	492	71,063	72,016	43,323	11,801

In the 1925–26 period there were also operating in the Dominion four milk-powder factories (one whole-milk and three skim-milk plants), four casein-factories, one condensed-milk factory, and one sugar-of-milk factory.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 6th May to 1st July, 1926, include the following of agricultural interest:—

No. 54093: Process for ascertaining fat-content of milk and cream; Hoyberg Company, Copenhagen, Denmark. No. 54457: Plough-lifting mechanism; W. M. Murray, Clydevale. No. 54534: Hedge-cutting machine; J. Johnston, jun., Invercargill. No. 54639: Wire-strainer; W. D. Nolan, Okuru. No. 55319: Cattle-mark; J. W. N. Gerritsen, Zeist, Holland. No. 56075: Plough-raising means; H. G. Cross, Christchurch. No. 56186: Milk pasteurizing and cooling; R. Wildridge, Sydney, N.S.W. No. 56203: Cream-can-emptying means; E. D. Berry, Palmerston North. No. 53926: Cheese-manufacture; I. Clark, Tisbury. No. 53942: Stack-cover; N. Ham, Orini. No. 55606: Seed-hulling machine; F. S. Hill, Cobden, Victoria. No. 53872: Cheese-press; R. Wyeth, Otautau. No. 54742: Plough-lifting and depth-regulating; J. McRae, Springburn. No. 54764: Weed-destroying method; H. Newrick, Wanganui. No. 56277: Milk-agitator; Dunn Bros., Ltd., Gore. No. 56382: Cattle-food; N. K. A. Albrektsson, Limhamm, Sweden. No. 55171: Butter-table; H. Ashworth, Wellington. No. 56411: Milking-machine releaser; C. A. Martin, Hamilton. No. 56477: Sheep-shearing machine; W. S. Whitcomb, Denver, U.S.A.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, Price 1s.

STOCK SLAUGHTERED, 1925-26.

THE following are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1926:—

Stock.	Abattoirs.	Meat-export Works.	Bacon-factories.	Ordinary Slaughterhouses.	Totals.
Cattle ..	157,668	206,904	..	93,259	457,831
Calves ..	43,242	31,358	..	2,670	77,270
Sheep ..	512,515	2,292,257	..	221,355	3,026,127
Lambs ..	85,198	5,055,245	..	20,498	5,160,941
Swine ..	127,216	159,852	42,922	28,349	358,339

INTERIM RETURN OF SHEEP AT 30th APRIL, 1926.

District.	Number of Sheep.		Difference.
	Final Return, 1925.	Interim Return, 1926.	
Auckland	2,092,244	2,225,878	+ 133,634
Gisborne - Hawke's Bay ..	6,344,990	6,210,877	− 134,113
Wellington - West Coast ..	5,282,307	5,347,909	+ 65,602
North Island totals ..	13,719,541	13,784,664	+ 65,123
Marlborough-Nelson-Westland ..	1,351,889	1,303,003	− 48,886
Canterbury-Kaikoura	4,984,062	4,912,152	− 71,910
Otago	4,492,463	4,748,029	+ 255,566
South Island totals ..	10,828,414	10,963,184	+ 134,770
Dominion totals ..	24,547,955	24,747,848	+ 199,893

The New Zealand

Journal of Agriculture.

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THE GRASSLANDS OF NEW ZEALAND.

SERIES II. THE MID-WEST NORTH ISLAND HILL COUNTRY.

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

GRASSES AND CLOVERS FOR HILL COUNTRY—*continued.*

Cocksfoot (*Dactylis glomerata*).

COCKSFOOT has been called " king " of the grasses, and under certain environmental conditions related to the soil and to pasture-management one cannot deny regal place to it. Regal place, however, in any one paddock may be claimed for most grasses, succession to dominance being governed almost entirely by environmental conditions set up by the farmer himself.

In the preceding article of this series (*Journal* for May last) the writer aimed to show how conditions of environment influenced the persistence or the running-out of perennial rye-grass on hill country. The ideal or acme of perfection in grassland—whether on hill or low country—is a mixed sward with perennial rye-grass as the dominant element. When perennial rye-grass is king the grassland farmer should be a prosperous and happy subject. Cocksfoot, in the writer's opinion, ranks second to perennial rye-grass, and when cocksfoot is present as a dominant in the sward the farmer may still reckon on a high-yielding, good-quality pasture, although he should firmly bear in mind that an increasing dominance of cocksfoot must be regarded as a falling-away from the possible ideal.

In the early stage of primary forest burns on the hill country perennial rye-grass is dominant (Fig. 62, May *Journal*). As the soil-fertility falls and the soil-surface conditions become harder, owing to loss of humus and ash, perennial rye-grass begins to dwindle and to fall off in production. At this stage one finds cocksfoot coming to the fore as the dominant of the hill-country pasture (Fig. 64). Many thousands of acres of hill country have been so managed that this desirable sward has been largely retained, and where this has been accomplished under ordinary grassland grazing-conditions much praise must be given to the farmer himself (Fig. 65).

Over the wide range of the hill-country soils we see cocksfoot in varying degrees of dominance, from the almost pure stands of vigorous, healthy plants to small, insignificant, stunted, dried-up, weak plants just persisting among danthonia or brown-top, or in a general run-out weedy pasture of catsear, hawkweed, rib-grass, self-heal, &c.

Wherever the fertility is fairly high, and where rotational grazing in contradistinction to close and continuous grazing has been adopted, cocksfoot remains a permanent constituent of the sward (Fig. 66). In the early bush-burn days the spelling of the burn pasture was a very common practice, and on these areas cocksfoot took charge, as indicated by the large quantities of cocksfoot-seed that was harvested from the bush country, particularly so in Taranaki. On Banks Peninsula spelling of the hill country is still practised, and cocksfoot remains as a dominant there; and the more the area is spelled and the less it is grazed the purer the dominance of cocksfoot becomes (Figs. 67 and 68). The entire spelling of hill country affords cocksfoot the two essentials for its proper development: (1) By the ever-increasing decaying leafage the fertility of the soil remains high, and (2) the growing top creates the necessary shady conditions for the crown of the plant.

Of the general grazed country, the gullies, the richer slopes, the foothills, and the camping-places all have their quota of cocksfoot, associated with rye-grass, white clover, crested dogstail, and Poa pratensis. Where rye-grass is luxuriant and the pasture is kept reasonably short, cocksfoot is subjected to second or third place in the sward. Heavy grazing and much treading is a deterrent to cocksfoot-development, whereas they favour rye-grass very markedly, so that under these conditions cocksfoot may be found occupying but a small place only as a herbage-producer in the pasture, rye-grass easily being the dominant. A condition under which cocksfoot on rich soils does gain the upper hand of rye-grass is when the pasture is allowed to get away rank, so that the taller growth of the cocksfoot actually smothers out the rye-grass. Cocksfoot is essentially a top grass, a shade-endurer, and a shade-demander; rye-grass is a bottom grass, and will not tolerate dense shade. Cocksfoot associates quite well with white clover, but the same precautions must be observed as with rye-grass. Strong-growing cocksfoot allowed to overdevelop will smother out white clover. This is true, practically speaking, of all pasture species associated with cocksfoot—paspalum being an exception. The heavy top growth of cocksfoot, its tendency to form large outspreading tussocks, and its rather unpalatable herbage when it does get away, tend to make for a pure cocksfoot sward rather than for a well-balanced mixed pasture.

The light-and-shade factor plays a most important part with cocksfoot. Grazed too closely, the crown, from whence the new roots arise, becomes exposed to drying winds and to the heat of the sun, and too much light is allowed access to it. If the pasture is spelled the crowns are shaded, and the cocksfoot seems to take on new life. If allowed to grow rank the dense shade created kills out all the associate species, and the pasture becomes a pure cocksfoot association.

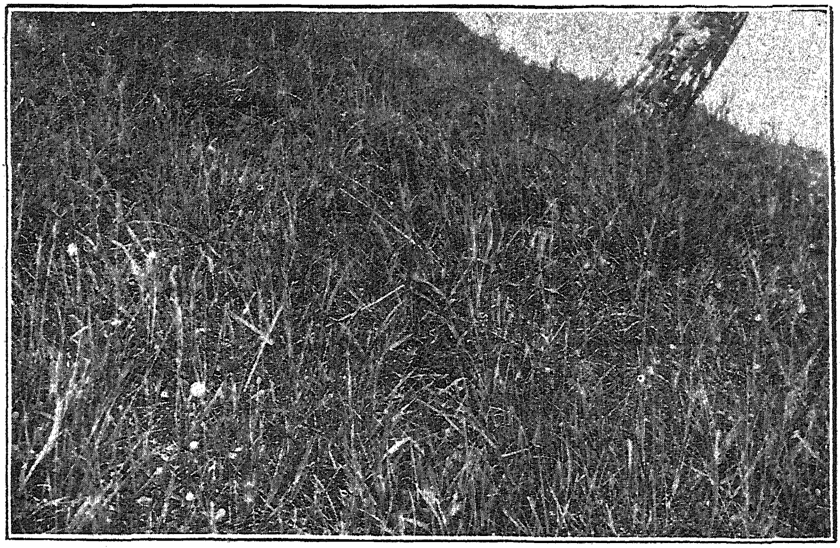

FIG. 64. COCKSFOOT AS DOMINANT ON PRIMARY BURN.

When the fertility of the bush-burn has become too low for rye-grass to flourish strongly cocksfoot comes to the fore. Dominance of cocksfoot on bush-burns, however, may be brought about through prolonged spelling of the area.

FIG. 65. GOOD EXAMPLE OF COCKSFOOT-MAINTENANCE ON A GRAZED AREA, NORTH AUCKLAND.

Owing to the heart not being eaten out of the grass through close and continuous grazing, coupled with a moderately fertile soil, cocksfoot bids fair to hold indefinitely on this area.

[*Photos by E. Bruce Levy.*

It will thus be seen that management has a big influence—apart from soil conditions—in deciding whether the pasture is to become dominated by cocksfoot (Fig. 69), whether there is to be a mixed pasture with cocksfoot as an associate species (Fig. 70), or whether cocksfoot will dwindle and die out from the area altogether (Fig. 66). On the sunny slopes of the hillsides it is more difficult to hold cocksfoot than on the shady slopes, and the reasons for this, again, are related to the shade-requirement of the cocksfoot itself. Stock are generally drawn to the sunny slopes because of the more pleasant living-conditions. These parts are then grazed closer than the shady slopes, which increases the amount of light reaching the crown of the plant. On the shady

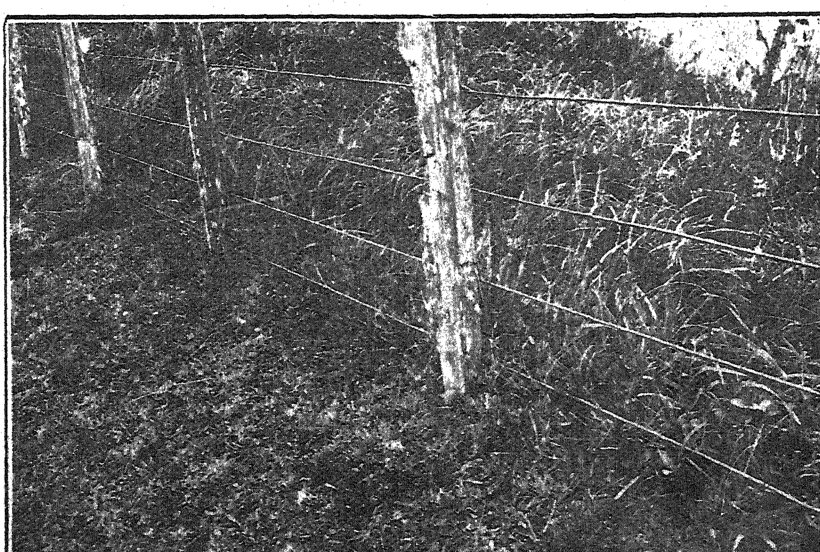

FIG. 66. CLOSE, CONTINUOUS GRAZING COMPARED WITH ROTATIONAL GRAZING.

Hill-country pasture sown about twenty-five years ago. On left, scarcely a sign of cocksfoot under pernicious system of close and continuous grazing. On right (through fence), cocksfoot dominant under rotational grazing.

[*Photo by E. Bruce Levy.*

slopes stocking is not so constant nor so heavy; consequently the cocksfoot is allowed to get away, and that intensifies shade to the crown of the plant.

With a plant such as cocksfoot on the hill country, therefore, it will be seen that great possibilities, both for good and for ill, present themselves. In the first two or three years after the sowing of the primary burn cocksfoot may become a pure association. It may then be allowed to become tussocky and overdevelop to the detriment of the associate bottom grasses and clovers. Then, when cleaned up by cattle and further eaten out by sheep, the tussocks are greatly reduced in size, and a bare, open pasture invariably results. White clover may spread rapidly through such a cleaned-up and open pasture—provided

FIG. 67. COCKSFOOT AT AKAROA, SHOWING PURE DOMINANCE UNDER COMPLETE SPELLING AND SEEDING PRACTICE.

[*Photo by W. D. Reid.*

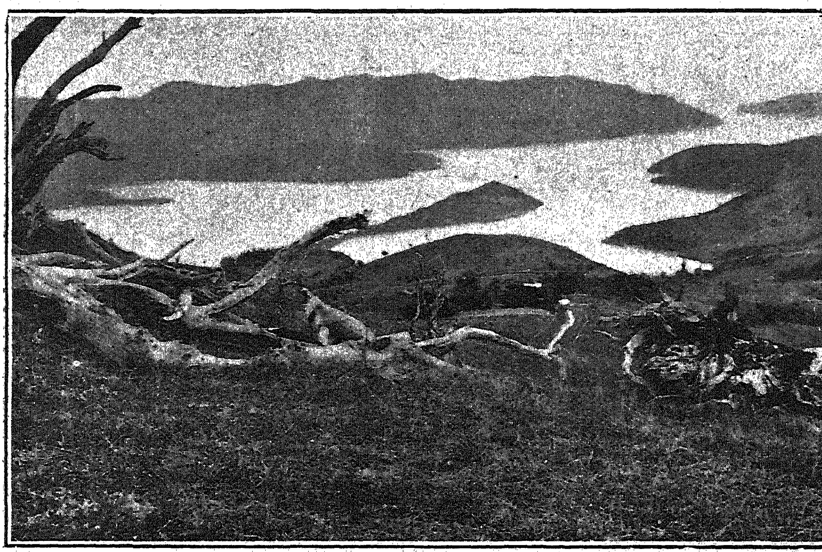

FIG. 68. COCKSFOOT AT AKAROA, SHOWING DOMINANCE OF COCKSFOOT UNDER SPELLING FOR SEED-PRODUCTION COUPLED WITH WINTER GRAZING.

White clover and Yorkshire fog often become subdominant in cocksfoot areas where winter grazing is adopted.

[*Photo by E. Bruce Levy.*

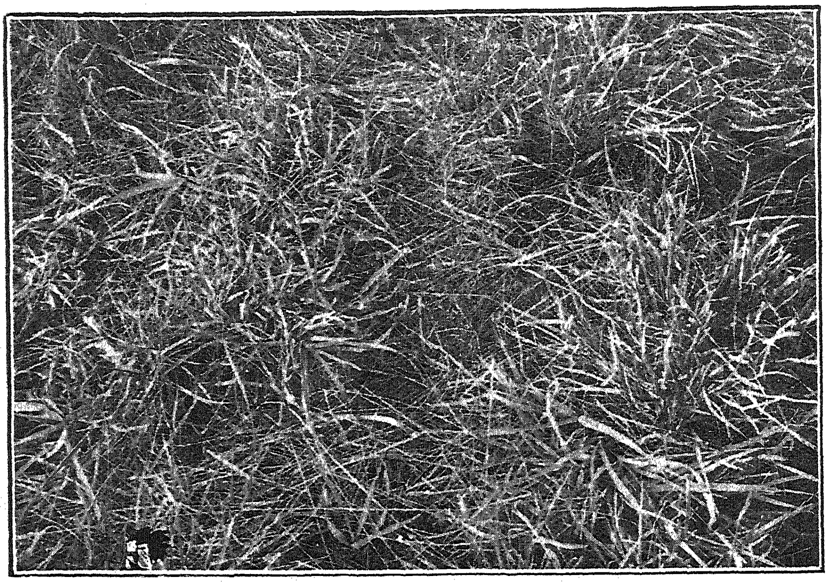

FIG. 69. COCKSFOOT THAT HAS OVERDEVELOPED AND HAS BEEN CLEANED UP SUBSEQUENTLY BY CATTLE.

Note the big tussocks of cocksfoot and absence of associate species, which have been killed out by the cocksfoot smother.

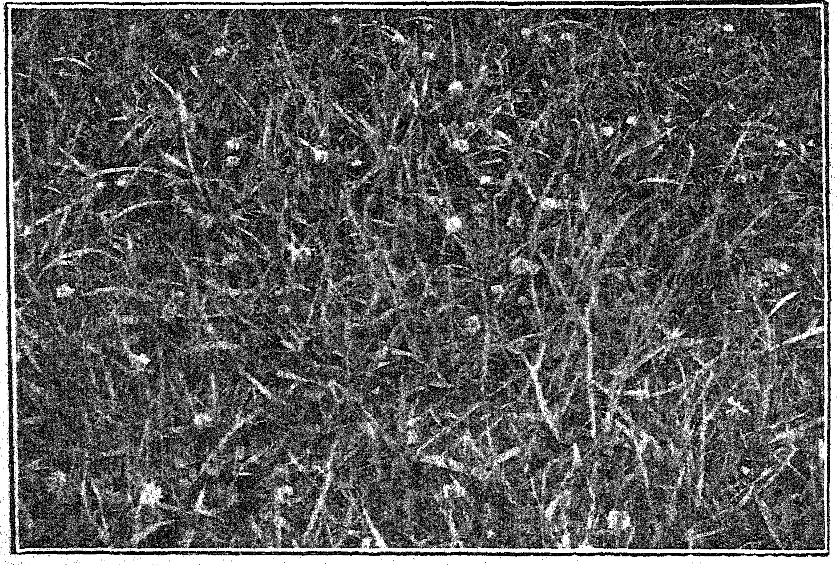

FIG. 70. COCKSFOOT AS A DOMINANT KEPT WELL IN HAND BY JUDICIOUS GRAZING.

Note the beautiful association of white clover and a certain amount of rye-grass with the cocksfoot.

[*Photos by E. Bruce Levy.*

the soil-fertility still remains high—but more frequently there results a numerous invasion of catsear, hawkweed, rib-grass, field-daisy, self-heal, cudweed, ragwort, piripiri, &c. (Fig. 71).

Cocksfoot will persist and thrive on soils that are not quite good enough for rye-grass, and on soils that are inclined to dry out somewhat in the summer it is found that cocksfoot usually gains the mastery over rye-grass. Cocksfoot will not thrive well on poor soils, and never on poor soils does it form a complete cover under grazed conditions. While the fertility of the bush-burn is high cocksfoot persists and grows strongly, but so soon as a reduction in fertility takes place the foliage loses its dark-green, healthy appearance, becoming yellow and stunted, and presenting quite an unpalatable herbage (Fig. 72). The tussock plant dwindles in size, few tillers are formed, and a decided opening-up of the pasture takes place (Fig. 73). Deterioration of the hill country to inferior grasses or weeds or secondary growth is bound to take place at this juncture.

Cocksfoot is generally regarded as a deep-rooting grass, and there is no doubt that under good conditions the new roots formed at the crown fairly rapidly penetrate into the soil and serve to anchor the plant firmly. On the other hand, when it becomes weakly, and when the crown becomes exposed to drying wind and sun so that scarcely any new roots are formed, the plant, owing to the dying and decay of the old root-system, becomes most insecurely held in the soil, and is readily pulled or knocked out by stock (Fig. 74). The binding of cocksfoot by some associate grass, such as Poa pratensis, on loose friable hill-country soils lessens to some extent the pulling-out of the cocksfoot-plants; but by far and away the better practice is to keep the cocksfoot-plants strong and healthy by manuring, and to allow a certain amount of get-away of the foliage so that the crown is shaded, particularly in the early spring and after the first rains of autumn.

POSITION OF COCKSFOOT SUMMED UP.

Summing up the position of cocksfoot on hill country in general, it must be admitted that this grass has not stood the test of present-day farming methods. Cocksfoot has been sown in varying amounts on virtually every acre of hill country that has been felled and grassed. It has more or less failed on all the country that has reverted to secondary growth; on all the country that has run predominately to brown-top, Danthonia pilosa, paspalum, or ratstail; and on all the country where herb-like weeds such as catsear, hawkweed, rib-grass, cudweed, piripiri, &c., have gained the upper hand (Fig. 75). This seems rather a sweeping statement to make, but who can gainsay the predominance of one or more of these grasses or weeds on vast areas of hill country in New Zealand? Had due regard to the growth-form of the cocksfoot-plant been taken, and had rotational grazing been practised instead of close and continuous grazing, we might now have been able to claim for cocksfoot a very much greater place on the hill country of New Zealand.

It is not too late, however, to make amends. Innumerable plants of cocksfoot still persist as stunted vestiges among the weeds and inferior grasses. The writer ventures to say that spelling such country

for a whole growing season, increasing its fertility by top-dressing or other means, and thereafter adopting rotational grazing would greatly improve the outlook for cocksfoot on most of the hill country. Cocksfoot is a high-yielding plant ; a permanent high-yielding plant is a great drain on any soil ; the soil can only yield up its natural endowment, and when this is exhausted starvation conditions prevail. Cocksfoot adapts itself to the infertile soil conditions, dwindling in size to a mere vestige, to persist as such until the farmer wakes up to the deplorably barren state his grassland soils have reached.

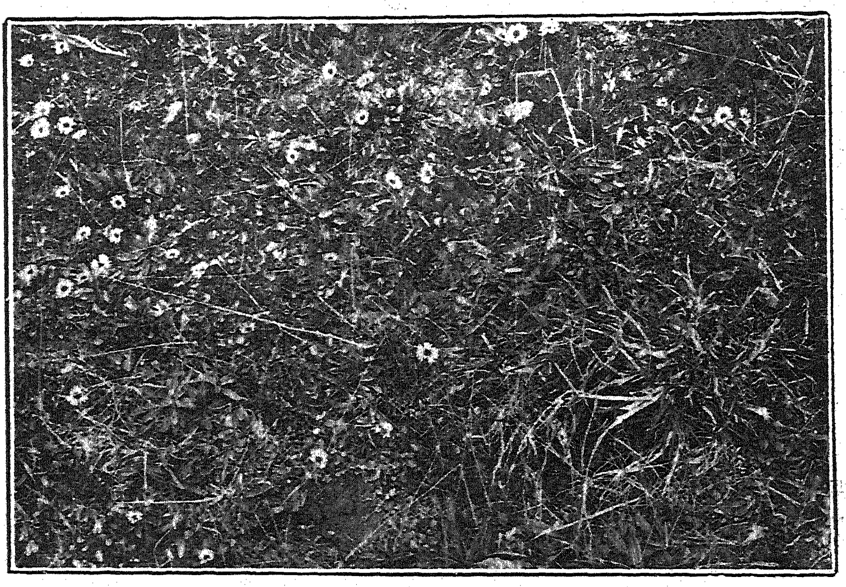

FIG. 71. COCKSFOOT AREA AT AKAROA WHERE COCKSFOOT WAS AT ONE TIME CUT FOR SEED, NOW GRAZED CONTINUOUSLY FOR DAIRYING.

Cocksfoot has considerably declined, and the open sward has become invaded by rib-grass, field-daisy, catsear, &c. This is an intermediate stage on Akaroa country between the pure cocksfoot phase and the danthonia-dominant phase, which latter comes later under close and continuous grazing for ten years or more.

[*Photo by E. Bruce Levy.*

POSSIBILITIES OF PLANT-BREEDING.

The plant-breeder may be able by selection to give us more permanent strains of cocksfoot, and the farmer, by sowing seed of approved strains, may be able to ward off to some extent the disappearance of this grass from our hill lands. Professor R. G. Stapledon's* work at the Welsh Plant-breeding Station, Aberystwyth, is full of promise in this respect. Strong-tillering forms, with the crown as deep into the ground as possible, have a decided advantage over weak-tillering forms that are inclined to run up to top rather than to good

* The writer has recently had the pleasure of conducting Professor Stapledon over the major grassland types in New Zealand, and it is felt that much good will be derived from his visit to the Dominion, by the exchange of views on grassland problems.

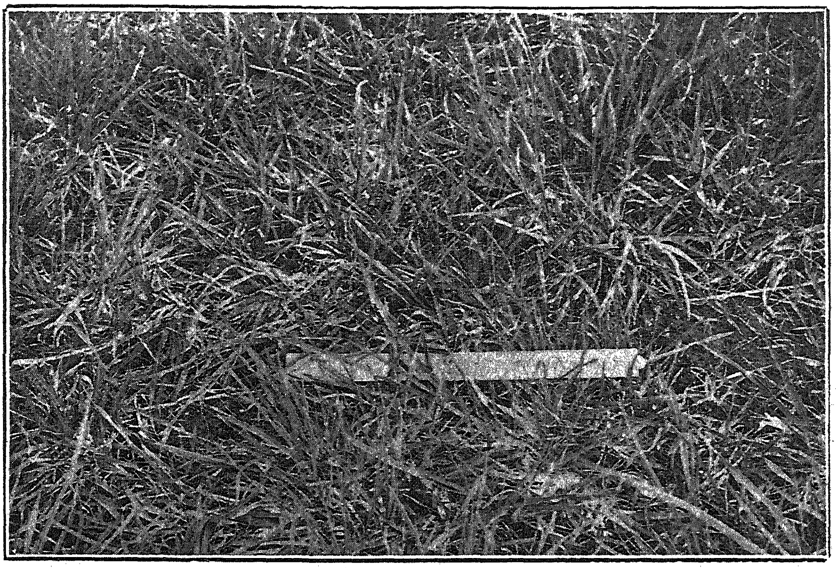

FIG. 72. COCKSFOOT BEGINNING TO DWINDLE AS THE FERTILITY OF THE SOIL BECOMES REDUCED.

Herbage yellow and stunted, and quite unpalatable to stock.

FIG. 73. COCKSFOOT UNDER LOW SOIL FERTILITY.

The plants have dwindled considerably, and the pasture is now open to invasion by inferior grasses, weeds, or secondary growth.

[*Photos by E. Bruce Levy.*

bottom growth. Akaroa cocksfoot, according to Professor Stapledon, approaches nearer to the ideal form of the plant than does Danish cocksfoot. The former is more inclined to tiller out strongly with widely divergent shoots, while the latter is less inclined to tiller, and the shoots are more inclined to become erect. The ordinary form of cocksfoot, however, will have to be modified to a large extent by the breeder before the plant can stand close and continuous grazing by sheep.

Again, the writer is of the opinion that no amount of plant-breeding will produce a cocksfoot that will grow strongly and be of permanent high production on poor soils. High production is possible only under adequate feeding of the plant, and the skill of the plant-breeder in producing high-production strains is of avail only when accompanied by proper manuring of the strains selected. With an annual crop the ground can be greatly improved by fallowing and liberal cultivation, and the manure applied at the time of sowing can easily be augmented to cater for any increased demand the high-producing strain makes on the soil. But in the case of plants permanently occupying the ground, if we put on to that soil higher-producing strains and fail to make good the annual loss of plant-food taken by such plants it simply means that the higher producer will exhaust the supply of plant-food in that soil sooner than would a lower-production strain. Therefore permanency in cocksfoot, or in any other plant, on soils where the outgo of plant-food cannot be made good must be achieved by the plant-breeder along the lines of selecting low-production rather than high-production strains. On the other hand, where plant-food is plentiful, or where it can be augmented at the will of the farmer, there are immense possibilities for the plant-breeder. In the matter of breeding of pasture-plants—our mainstay of production—this country is decidedly weak.

COCKSFOOT UNDER SHADY SECONDARY-GROWTH CONDITIONS.

As already mentioned, cocksfoot is a shade-endurer, and it persists for many years in the shade of the lighter types of secondary growth. It is, however, of little value in the control of secondary growth, owing to the fact that it will not endure a severe fire. With a good deal of cocksfoot among secondary growth crushing out with cattle is generally to be preferred to burning, but where the growth is dense the cocksfoot has become so weak that burning or crushing usually kills the old weakened plants. When in dense shade the crown of cocksfoot rises well above the level of the soil, so that even if the plant escapes death by burning it is not long before it is pulled or knocked out of the ground by stock.

COCKSFOOT IN PRIMARY AND SECONDARY BURNS.

From what has been said it will be seen that cocksfoot, like rye-grass, has its limits and shortcomings on hill country in New Zealand, and particularly so under the present system of close and continuous grazing by sheep. On new primary burns, however, there certainly is a place for cocksfoot. It works admirably as a follower to perennial rye-grass when the high fertility of the burn begins to lessen. The plant is a fairly rapid establisher from seed, and the seed is not

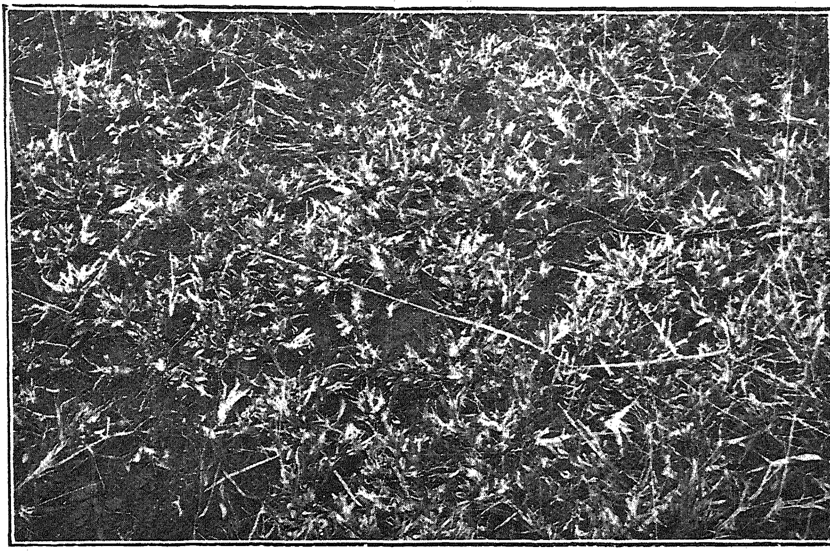

FIG. 74. COCKSFOOT CLOSELY GRAZED TO THE CROWN.

New roots cannot develop from these exposed crowns, and as soon as the old root-system dies away the plant becomes most insecurely anchored in the soil. Under these conditions the plants are easily pulled out by stock.

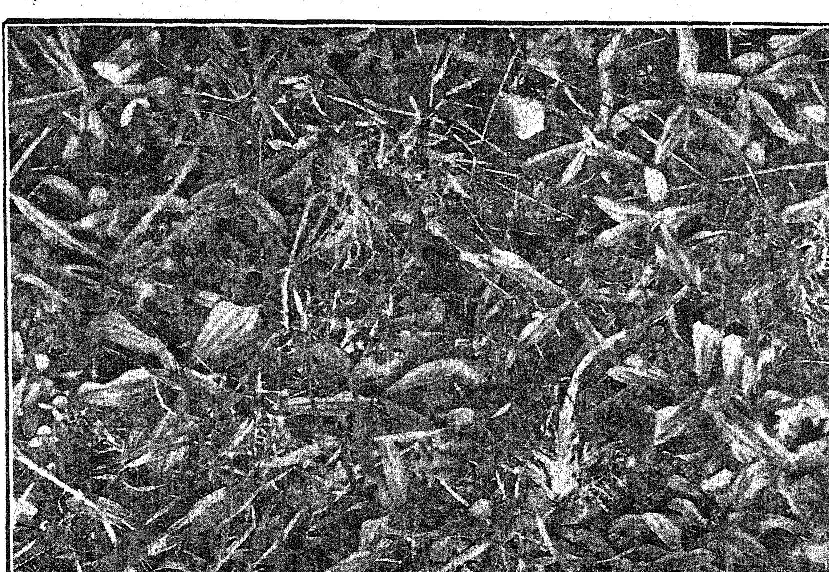

FIG. 75. A STRIKING EXAMPLE OF THE FAILURE OF COCKSFOOT.

When cocksfoot fails, secondary growths or inferior grasses or weeds, as shown in photo, are bound to put in an appearance. The coming-in of these is a certain indication that cocksfoot is failing.

[*Photos by E. Bruce Levy.*

unreasonably expensive. As with rye-grass, however, complete reliance should not be placed on cocksfoot. These two species in themselves are not sufficient to permanently and successfully grass the hill-slopes, and the poorer the country the less can we rely on rye-grass and cocksfoot. On average slopes 8 lb. to 10 lb. of cocksfoot in the mixture for the primary burn is sufficient.

With regard to the secondary burn, the inclusion of cocksfoot in the mixture seems almost a waste of good seed and money. Where tall dense bracken, wineberry, fuchsia, or strong-growing manuka is being cleared, burnt, and sown, or where top-dressing of the secondary burn with artificial manures is possible, then it may well repay the farmer to include 3 lb. to 4 lb. of cocksfoot-seed per acre in the mixture sown. When dealing, however, with stunted bracken, short manuka, hard fern, &c., the inclusion of cocksfoot may certainly be regarded as waste.

In the Department's experiments at Whangamomona cocksfoot has proved one of the most expensive of plants to establish. In the first year it cost ten times as much to cover the ground with cocksfoot herbage as it did with rye-grass, twelve times as much as with crested dogstail, and about sixteen times as much as with brown-top. In analyses made so far this year on the same plots—two years after sowing—the position of cocksfoot in the plots sown has become worse rather than better. From these results, therefore, it seems imperative that the farmer should rely scarcely at all on cocksfoot for sowing his secondary burns. If he considers the country he is cleaning up is above the average, then the inclusion of from 3 lb. to 4 lb. of cocksfoot may be justified, but on no consideration should money be spent on cocksfoot unless he can afford to buy this seed in addition to the full quota of certain of the hardier grasses and clovers to be mentioned in a later article.

CONCLUSION.

In conclusion, cocksfoot, together with perennial rye-grass, has sadly declined on hill country, and for this decline two major factors are largely responsible: (1) The depletion of fertility; (2) the pernicious system of close and continuous grazing by sheep. In addition to a plentiful supply of plant-food cocksfoot must have shade for its crown at certain periods of the year. To the writer there does seem the possibility of a great improvement as regards cocksfoot—apart altogether from top-dressing—if only farmers could adopt a rotational system of grazing rather than the close and continuous system so common over most of the hill country.

(Series to be continued.)

Production of Casein.—The annual report of the Dairy Division for 1925–26 states: "The quality of casein manufactured in the Dominion is now of a high standard, a noticeable improvement in the green curd being evidenced. Manufacturers are now producing a high-grade rennet casein containing a minimum quantity of butterfat. This casein has a high marketable value. Production has not been so high, this being to some extent attributable to a number of dairy companies reverting to cheese and home separation during the year. The quantities graded for export amounted to 1,126 tons lactic and 624 tons rennet casein, a total of 1,750 tons."

CHRONIC HÆMATURIA AFFECTING CATTLE.

NOTES ON CASES IN THE SOUTH ISLAND WEST COAST DISTRICT.

J. KERRIGAN, M.R.C.V.S., District Superintendent, Department of Agriculture Christchurch.

CHRONIC hæmaturia, a disease affecting cattle—especially dairy cows—is characterized by intermittent periods during which the urine discharged contains varying quantities of blood. The disease is usually of comparatively long duration. During the past year I have met with two typical cases and have heard of several others. So far as can be ascertained the disease has not been reported previously in New Zealand.

Chronic hæmaturia was noted in France as far back as 1864, and in other Continental countries at later dates. In British Columbia it evidently caused serious losses in certain districts, and the trouble was carefully studied by Bowhill and Seymour Hadwen between the years 1907 and 1912. It has also been noted in Africa and other countries. Only within comparatively recent years has the disease been observed in Britain. Late in 1914 Wallis Hoare stated that, so far as he was aware, it had not been noted in the British Isles. J. F. Craig, of Dublin Veterinary College, who in conjunction with D. Kehoe studied this trouble within recent years in Ireland, states: "Our first suspicion of the presence of chronic hæmaturia in this country (Ireland) was aroused about 1917, but it was not until 1922 that an opportunity arose to investigate it in two cows, and later in a third one, and to show that it is identical in all its details to that noted in other countries." He further remarks: "One may be allowed, however, to state at once that there is every reason to believe that this condition is not of recent introduction into the country, but has for a long time remained unrecognized and has frequently been mistaken for redwater."

LOCAL CASES.

In the various districts in New Zealand in which I have been located or have travelled I have now and again been asked to advise regarding the treatment of a cow or cows affected with redwater. On several occasions during the past seven or eight years similar requests came from the Murchison and Inangahua districts, but no opportunity occurred of examining an affected animal. When lecturing at the Department's winter farm school on the West Coast during June of last year I was again asked to advise regarding the treatment for so-called redwater. However, on discussing the matter with three of the settlers I strongly suspected that their cows were affected with chronic hæmaturia and not redwater. I advised the settlers accordingly, and asked them to keep in touch with the Stock Inspector for the district and with myself, so that if an opportunity occurred the trouble might be investigated.

In December last information was received that there was an opportunity of seeing two or more affected cows. Mr. P. McGregor,

Departmental Veterinarian, visited the district, and, without knowing that I had strong suspicions of chronic hæmaturia as affecting cows in that area, his report strengthened my suspicions. In fact, in his report he gave the following description of some of the typical symptoms: "Firstly, the animals were seen to pass bloody urine. No condition was lost, nor was the milk-supply diminished in the first stages. The cows generally became affected at calving-time in September, and except in isolated cases the urine cleared during the summer—the animal having apparently recovered. In the following spring at calving-time the urine again became bloody, and in this case it became gradually thicker, until there was passed with the urine a stringy, leathery substance in the form of clots. Shortly after this condition began the animal rapidly lost condition and died. In some cases the animal would apparently again recover during the second summer, only to become again affected the following spring and die." Mr. McGregor did not make a *post mortem* examination of any of the affected cows, as those he examined were only slightly affected, and he considered it advisable to await further developments.

In March of this year Mr. C. S. Neville, Inspector of Stock, while in the district on other matters, had an opportunity of making a post-mortem on an affected cow, and he sent the bladder to the Wallaceville Laboratory. This exhibited typical symptoms said to be found present in cases of chronic hæmaturia. In April, in company with Mr. Neville, I made a post-mortem on an affected cow, and we saw another one only slightly affected. Although the cow on which we made the post-mortem was not in the advanced stages of the disease, the changes found present were typical of chronic hæmaturia, and crystals of calcium oxalate were found present in the urine.

The area in which the trouble occurs is somewhat isolated and difficult to keep in close touch with, consequently only a limited number of cases have come under my notice, and I am indebted to former investigators for some of the following information.

The animals affected are generally matured cows (five years old and over), but occasionally younger animals have been noted as exhibiting typical symptoms. It is stated that occasionally a bull has died of the trouble, and Mr. Neville informs me that from inquiries he has learned that a certain number of working-bullocks in the early days in the Murchison district were similarly affected and died.

The area in which the disease appears lies roughly between Reefton and Murchison, and is (or had been prior to clearing) covered with what the settlers call brown, black, silver, or red birch—correctly beech (*Nothofagus*) species. When the bush is felled the land runs very rapidly into bracken fern. It will be understood from this that in general the land has not been improved to any extent by the addition of artificial manures, &c.

One or more cows may be affected on the farm at the same time, but, of course, this depends to some extent on the number kept. One farmer informed me that during the past five years his loss out of a herd of twenty-six cows had been thirteen, equal to 10 per cent. The cows are generally turned out into the bush when dry, and are brought in again in the spring.

SYMPTOMS.

Symptoms are as follows: Greater or less discoloration of the urine—generally in spring when the animal is brought in. The colour may be brown or red, or blood-clots may be passed, and the animal may occasionally strain. Apart from this, it appears to be in good health and otherwise normal. It may remain in this condition for a varying period, but in general as the flush of grass comes on in summer the animal apparently recovers. In the autumn the urine discharged may again be mixed with blood, or the trouble may not appear again until the following spring, and if the urine is badly affected it may contain so much blood that it sets to a reddish jelly soon after being passed. The affected animal may succumb to the first attack, or it may have several attacks. I have heard of one cow that has shown this discoloration of urine on different occasions for four years.

As a result of the loss of blood the animal ultimately loses condition, generally exhibits dropsical swellings under the lower jaw or in the dewlap, and diarrhœa may appear in the last stages. It is stated that excitement exaggerates the symptoms, and that once the animal becomes affected it rarely actually recovers, also that the symptoms become more marked with each attack. Some cows apparently resist the disease, as one owner informed me that he had cows that had been respectively eight, ten, and thirteen years on the affected area and had never shown any symptoms of the trouble.

Under *post mortem* examination the bladder contains a varying quantity of urine mixed with blood, and generally crystals of calcium oxalate can be found in the urine. The bladder is the only organ showing any important lesions. The mucous membrane lining this organ is rough, and contains a number of small red spots, patches, and streaks; in the one I examined at two places there appeared also to be some granulation tissue. It is stated by investigators that in advanced cases growths of a fibro-papillomatous nature are found present in the bladder.

CAUSES AND TREATMENT.

A number of causes have been suggested by investigators. It has been suggested that the disease is caused by some poisonous plant, but the actual plant so far has not been determined. Others consider the trouble may be microbic in origin or that it may be caused by parasites, but investigations so far have not supported these suggestions. Hadwen apparently demonstrated that all the appearances presented in the disease could be produced by large doses of oxalic acid given over an extended period of two years. It is therefore not improbable that the disease may result from oxalic-acid contents of the herbage on which the cattle are allowed to graze for a long time, or to some toxic substances in the pasture.

It has been stated that when 2 to 4 drachms of calcium lactate have been given daily for a week some improvement has been noted in the animal. Experience has evidently shown in France, British Columbia, and elsewhere that following agricultural improvements, such as better drainage and top-dressing with lime and manures, in the affected areas the disease tends to disappear.

FARM ECONOMICS.

WORK OF NEW BRANCH OF FIELDS DIVISION.

E. J. FAWCETT, M.A. (Cantab.), Fields Division, Department of Agriculture, Wellington.

A PROMINENT agricultural educationist of the United States, Dr. Liberty H. Bailey, once said that the requirements of a good farmer are at least four. They are these abilities: (1) To make a full and comfortable living from the land; (2) to rear a family comfortably and well; (3) to be of good service to the community; and (4) to leave the farm more productive than he found it.

Until comparatively recently agricultural educationists have been mainly concerned with the study and teaching of pure and applied sciences relative to farming, the business aspect of the industry being almost neglected. Undoubtedly the work of agricultural chemists, botanists, &c., has led to the collection of a great amount of information which has been instrumental in increasing production. Yet there are many farm operations possible which are not economically sound under every condition. The law of diminishing returns — which in effect means that after a certain point is reached subsequent applications of labour and capital will not raise production proportionately—comes into operation in agriculture perhaps more quickly than in any other industry. It was the realization of this fact which led to the rapid growth of the study of business and general management organization of the industry, first in America, then on the Continent of Europe, and next, in 1913, in Great Britain.

There are three factors controlling production—namely, land, labour, and capital. It is the business of the agricultural economist to study and investigate these factors, for it depends on their relationship to each other — the conditions of their supply, maintenance, and manipulation—whether the industry is profitable or not.

New Zealand is rapidly approaching the stage in its rural existence where it becomes essential that a study of these conditions as they affect production should be made if output is to be increased on lines calculated to better the farmer and increase the prosperity of the country. In the past the greater part of our agricultural instruction has been based on experience and observation, the business factors being more or less ignored. If the agricultural education and instruction of the future are to be sound they must be based on sound economic lines, and until a careful and systematic study of the basic factors governing local production is made any instruction given must be lacking in its first essentials.

Realizing the importance of such data, the Department of Agriculture has recently added to the activities of its Fields Division a branch of farm economics, with the object of developing investigation on these lines. As in the past the great source of our information has been the farmer himself, so in this investigation the farmer must be looked to to supply the necessary facts. One hears constantly such statements as "land is too dear"; "rates and taxes are too high"; "labour is prohibitive"; "money is unprocurable at a reasonable

rate of interest"; "I cannot afford to top-dress or subdivide"; and many others of a similar nature. Before any reform can be advocated, or any practice emphatically declared profitable or otherwise, it is necessary to know the position of the farming industry as it at present exists, and without the co-operation of the farmer very little can be done. The information required by the Fields Division must of necessity be of a private nature, but we feel that there are sufficient broad-minded men in New Zealand who will be only too willing to supply it, appreciating, as they must, its importance in our future development.

There are two methods used by investigators in Great Britain, the Continent of Europe, and America: (1) A system of cost accounting on individual farms; (2) an individual farm survey with estimation of expenditure and receipts. In both cases a study of management and general farming conditions must also be made.

It is desirable that a certain number of picked farms in each district be put under a very accurate system of costing, and that a large number be subjected to a survey so that they may be checked against the standard. In order to indicate to readers the type of information desired in the farm-survey investigation the items of the questionnaire to be used by the Fields Division are here reproduced as follows:—

Name and address:

County:

Data for year ending

1. Size of farm:
2. Tenure:
3. Description of farm:
4. Number of paddocks:
5. Estimated mileage of fencing, and cost:
6. Size of paddocks:
7. Cover of paddocks:
8. History of paddocks for four previous years:
9. Stock: Number and breed as at 31st March approximately:—
   Sheep—Ewes:
   Wethers:
   Hoggets:
   Others:
   Cattle—Dairy cows, eighteen months or over:
   Dairy heifers, under eighteen months:
   Hill cattle, eighteen months or over:
   Hill cattle, under eighteen months:
   Horses:
   Pigs:
10. Estimated value of farm equipment and buildings (not dwelling house): £
11. Type of farming practised:
12. Date of taking up farm:
13. Total number of family on farm—
    (*a.*) Under sixteen years: Male , female
    (*b.*) Over sixteen years: Male , female
    (*c.*) Helping on farm:
14. Personal capital put in on taking over farm: £
15. Mortgages: £
16. Interest on mortgages: £
17. Price per acre paid on taking up farm: £
18. Amount paid off since: £
19. Overdraft at bank: £
    Overdraft interest: £

20. Rent: £
21. Rates: £
22. Taxes: £
23. Gross takings for year ending : £
24. Gross expenses: £
25. Estimate of household expenses: £
26. Wages: £
27. State if labour is found in food:
28. Labour:—
    (a.) Number employed:
    (b.) Total weeks labour employed:
    (c.) How employed:
29. Main items of revenue:—
    Wool: £
    Meat for export—
        Sheep: £
        Cattle: £
    Fat stock for local market—
        Sheep: £
        Cattle: £
    Store sheep: £
    Store cattle: £
    Dairy cows: £
    Butterfat or milk: £
    Wheat: £
    Oats: £
    Chaff: £
    Other items:
30. Main items of expenditure not enumerated elsewhere:—
    Purchase of sheep: £
    Purchase of cattle: £
    Purchase of manures: £
    Other items:
31. Government valuation of farm: £

Short description of system of farm-management:

Any outstanding features:

Following are a number of economic problems which are urgently in need of solving. It will be quite readily seen that with a mass of data of the foregoing nature, collected from a wide range of farms, many of the urgent questions confronting the agricultural industry could be answered.

(1.) Farms arrange themselves in groups, each farm within that group being controlled by a similar combination of factors. Some show a profit, whilst others are worked at a loss. To what extent is it possible to alter the management of the low-producing farms so that they may be put on a sound basis?

(2.) In what proportions should land, labour, and capital be combined under different circumstances, such as nature of farming and locality, to give the highest net returns? In other words, what capital should a farmer possess in order to undertake, with a reasonable chance of success, a farm of any given size in any locality?

(3.) From what area of land under different types of farming can a man reasonably expect to make a management wage sufficiently high to enable him to provide for his family in comfort and give of his best to the State?

(4.) What is the crippling factor on many of our farms at the present day? Is it the high price of the land, high rates and taxes,

or over-capitalization in plant and improvements; or is it faulty management?

(5.) To what extent can such operations as subdivision, pasture top-dressing, provision of supplementary crops, and culling and improvement of stock be carried on economically?

(6.) What is the earning-value of land under average management skill on different types of soil in different localities under average marketing conditions?

These are some of the features which an investigation into farm management and costs would enable us to answer. It has been found in other countries that the greatest saving can be effected by rectifying farming conditions first. When the production end of the business has been placed on a sound footing, then attention can be given to other important questions such as exist between the producer and the ultimate consumer.

It is with this object in view that the Department has instituted its economic research branch. The aim is to help the farmer in every way, but to enable this to be done the farmer must also help the Department. By hearty co-operation we believe it possible to equip the farmer with such knowledge that he will be able to make a better and more comfortable living from the land, to rear his family in greater comfort, to be of better service to the community, and to leave his farm more productive than it is at present. Such a study as here outlined, in conjunction with the scientific study of other problems confronting the farming industry, is calculated to promote individual prosperity and to increase national wealth.

The Department appeals to farmers and others to assist in this undertaking. An assurance is given that information supplied will be treated as strictly confidential, and that subsequent publication of findings will be made in such a way that the identity of the individual will be completely obliterated. The writer of this article will be glad to receive inquiries from any farmer who may be interested in the work and who is willing to co-operate.

INOCULATION AGAINST BLACKLEG DISEASE.

IN his annual report for 1925–26 the Director of the Live-stock Division states:—

Blackleg is still confined to the Taranaki District and to a portion of the Auckland Province. Inoculation of calves in the latter district is only carried out in cases where the disease has been confirmed, but in Taranaki the practice has been to vaccinate independently of whether outbreaks have been reported. The number of calves vaccinated during the year in Taranaki was 32,389, being an increase of 3,128 on the previous year. In remarking on the matter the District Superintendent, Wellington, makes the following comment, which I commend for consideration, as from the experience gained of the result of a similar policy in the Auckland District I am satisfied it is in the best interests of all concerned: "I think the time has arrived when a relaxation in the regulations dealing with this disease could very well be introduced in Taranaki, on similar lines to the procedure adopted in the Auckland District. The number of actual deaths reported as due to blackleg is very small compared with the volume of work entailed in general vaccination. No case of blackleg has occurred in the Hawera district for over three years."

ACACIA GALL-FUNGUS.

G. H. CUNNINGHAM, Mycologist, Biological Laboratory, Wellington.

A SERIOUS disease of wattle, *Acacia decurrens*, has become general throughout New Zealand in recent years, and so many inquiries concerning it have been made that this article is written to supply information as to its cause and remedial treatment.

The disease is noticeable on account of the conspicuous, dusty-brown galls present on the stems, branches, and pods. These may

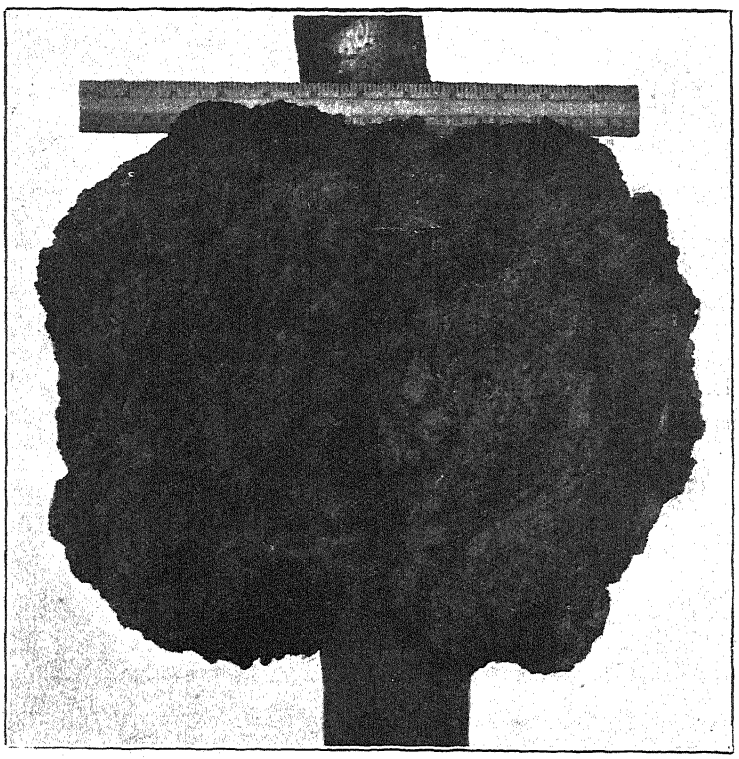

FIG. 1. GALL ON ACACIA-STEM, EXCEEDING 1 FT. IN DIAMETER.
[Photo by H. Drake.

remain for several seasons and, owing to their structure, seriously impair the work of the conduction-vessels of the branches; consequently the portions beyond the galls make little growth and produce few leaves. The tree thus suffers from partial starvation and eventually dies. In cases of severe infection trees may be killed outright in a season or so. A less noticeable feature of the disease is the production on leaves, petioles, and laterals of small, purple. blister-like spore-pustules.

The galls are commonly the size of a walnut, but may attain to a diameter of 1 ft. or more (Fig. 1). When sectioned they are seen usually to be tunnelled with the borings of insect larvæ, and this has led to the belief that the galls are due to insects. Such is not the case, however, for they are caused by one of the rust fungi, *Uromycladium notabile* McAlp., the spore masses of which cover the exterior of the galls, giving them a dusty-brown appearance. The insects are secondary, living at the expense of the gall, and are in no way connected with their formation.

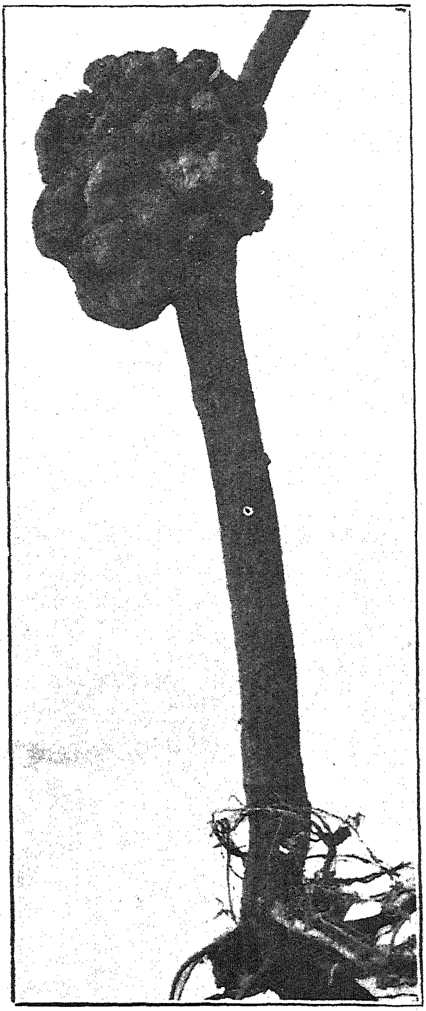

FIG. 2. GALL CAUSING DISTORTION OF STEM OF YEARLING ACACIA DECURRENS.

[*Photo by H. Drake.*

Spores (uredospores) are produced on the exterior of the galls, and these are detached and carried by the wind to other plants in the vicinity, where, should conditions prove favourable, they may germinate and cause further infection. In this manner the disease quickly spreads throughout the trees in a plantation. The mycelium of the fungus perennates in these galls, and produce each season over a period of years quantities of spores. Therefore, once a tree becomes infected it is a constant source of infection for other trees planted in the vicinity. As has been mentioned, spore-pustules are also produced on leaves, petioles, and laterals. These consist of a second type of spore (teleutospore), which germinate on reaching maturity (usually during the summer months) and produce basidiospores, also capable of infecting any host plant on which they may alight.

Little was known of this rust until 1905, when McAlpine (1) made an intensive study of this and other rusts attacking species of the genus *Acacia* in Australia. He found that it and several others confined to this host genus belonged to an undescribed genus of fungi which he named *Uromycladium*. McAlpine described seven species of *Uromycladium*, occurring in all on twenty-seven species of *Acacia*, and showed that the genus was essentially an Australian one.

The disease has been introduced into New Zealand on seedling plants, and has then been spread by means of infected plants throughout both Islands (Fig. 3).

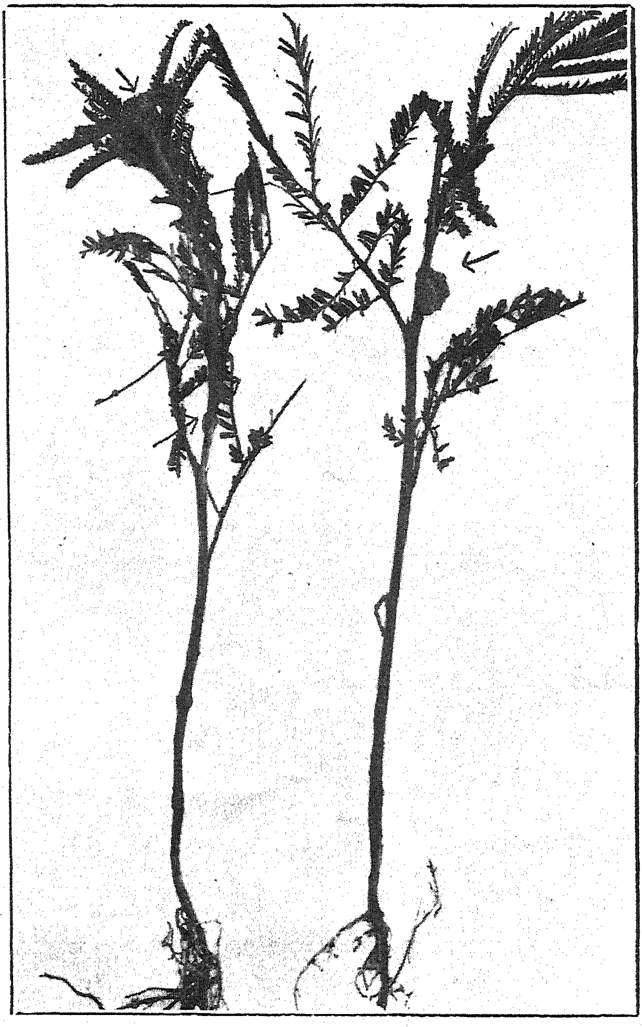

FIG. 3. GALLS (INDICATED BY ARROWS) ON SIX-MONTHS-OLD ACACIA-SEEDLINGS.

It is by the use of such plants that the disease is disseminated.

[*Photo by H. Drake.*

The species discussed above, *Uromycladium notabile*, usually occurs on *Acacia decurrens*, but it is not confined to this host, having been frequently collected on *A. Bayleyana* and occasionally on *A. dealbata*; in Australia and Tasmania it has in addition been recorded by McAlpine as attacking *A. binervata*, *A. elata*, *A. notabilis*, and *A. pruinosa*.

A second gall-forming species, *Uromycladium Tepperianum* McAlp., has been found in Auckland to attack prickly-acacia, *A. armata*, producing thereon a gall similar to that formed by *Uromycladium notabile*. In Australia and Tasmania this latter species appears to be abundant, for McAlpine records it on the following nineteen species of acacia: *A. armata*, *A. diffusa*, *A. erioclada*, *A. glaucoptera*, *A. hakeoides*, *A. implexa*, *A. juniperina*, *A. longifolia*, *A. melanoxylon*, *A. myrtifolia*, *A. pycnantha*, *A rigens*, *A. salicina*, *A. siculiformis*, *A. spinescens*,

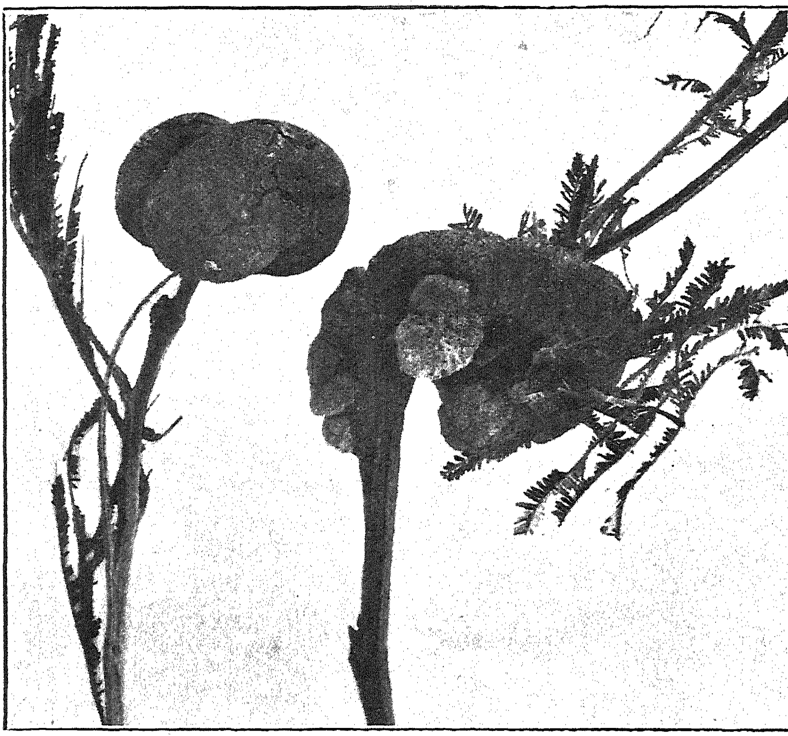

FIG. 4. SHOWING EFFECT OF GALLS ON LATERALS.

On right: Primary infection; note torsion, and that terminal portion of lateral continues beyond gall.

On left: Old gall showing destruction of terminal leaf-bearing portion of lateral.

[*Photo by H. Drake.*

A. stricta, *A. verniciflua*, *A. verticellata*, and *A. vomeriformis*. This species is stated to have been found also in Java on *Albizzia montana* (4).

Of the five other species recorded for Australia by McAlpine, three—*Uromycladium Acaciæ*, *U. alpinum*, and *U. Robinsoni*—have been collected in New Zealand (2, 3); but as they do not produce galls, and consequently do little damage to the host plants, they are of minor economic import.

REMEDIAL TREATMENT.

Nothing can be done with a tree once it has become infected. It has been suggested that the galls be removed and the sources of infection thereby destroyed. But this is impracticable, for, as has been shown, a second form of spore is present on the leaves, petioles, and laterals, which would lead to further infection.

FIG. 5. POD-INFECTION.

The galls usually destroy the pods, so that it frequently becomes difficult to secure seed from severely infected trees.

[*Photo by H. Drake.*

Avoidance of infected plants used in planting is the only method at hand whereby infection may be obviated. For this purpose it is necessary to secure seed from trees free from the disease, and to sow it in an area removed from the vicinity of infected trees. The common nursery practice of sowing seed from infected trees in their vicinity should be avoided. It is through this means that the disease has

become so widely disseminated throughout New Zealand in recent years, for the seedling plants become infected in the nursery through spores wind-borne from neighbouring infected trees, and carry the disease with them wherever they may be planted.

The writer is indebted to Mr. T. Rodda, Manager of the Te Kauwhata Horticultural Station, for information concerning the incidence and behaviour of the acacia gall-fungus at Te Kauwhata, and for forwarding specimens; and to Mr. H. Drake, of this Laboratory, for the accompanying photographs taken therefrom.

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NAURU AND OCEAN ISLANDS PHOSPHATE.

THE following is extracted from a statement on this subject in the annual report of the Director-General of Agriculture for 1925–26:—

"There are no harbours at the islands, the steamers during loading operations lying in the open roadstead anchored to special moorings which are in deeper water than perhaps any others in the world. Loading is carried out through the medium of lighters, hence shipping operations are governed almost entirely by weather conditions. For the first five years of the British Phosphate Commission's operations the weather interfered very little with loading operations, with the result that all orders from partner countries were promptly filled and surplus production disposed of to other countries at very profitable market rates. These conditions, which favoured a maximum output so necessary where heavy overhead charges are inevitable, were reflected in a gradually decreasing c.i.f. cost., with corresponding benefits to purchasers of the manufactured superphosphate. Unfortunately, very unfavourable weather conditions were experienced for a considerable portion of the year 1925–26, with the result that shipping operations were delayed, storage limits at the islands were reached, and it was impossible to supply from the islands all of the requirements of the partner countries. In order to furnish the manufacturers with raw material, and so ensure adequate supplies of superphosphate for consumers in the partner countries, the British Phosphate Commission, acting for the manufacturers, met the position by purchasing from the most favourable sources of supply (including Florida, U.S.A., and Morocco) the large quantities of phosphate rock needed to meet the deficiency. These purchases were, of course, at a greater cost than Nauru and Ocean Islands phosphate, but, in order to avoid fluctuations in the prices of superphosphate due to varying prices for the raw material, the Commission agreed to distribute the extra cost of the needed outside supplies by increasing by a small amount per ton the selling-price for the year commencing on the 1st July, 1926, and making the sales on terms convenient to the purchasers.

"Extensive improvements in the storage and shipping facilities at the islands are being arranged by the Commission with the object of reducing costs of production, increasing the output, and making possible speedier loading of vessels, and so utilizing to the utmost weather conditions favourable to the loading of ships. These works will take a number of years to effect, but when completed will enable the output to be greatly increased."

TREATMENT OF IRON-HUNGER IN STOCK.

THE PROPER USE OF IRON-AMMONIUM CITRATE.

B. C. ASTON, F.N.Z.Inst., Chemist to the Department of Agriculture.

THE use of double citrate of iron and ammonium in the prevention and cure of iron-hunger (bush sickness) has been so successful at Mamaku that many farmers on the sandy silt and coarser pumice lands have taken advantage of this Department's offer to supply the drug to *bona fide* farmers at cost price—3s. 3d. per pound—through the Stock Inspectors at Rotorua and Tauranga. So far as can be learnt, favourable results are being experienced by those who are trying the drug and who follow the instructions. It is important that the instructions should be followed as already given in the *Journal*. They are here repeated for general information :—

The dose for a cattle beast is 2 fluid ounces of a 6-per-cent. solution twice daily; 1 lb. of the crystals may be dissolved in 13½ pints of water to make this solution. The medicine may be sprinkled on hay or other fodder for ease of administration. For younger animals the dose should be proportionately reduced.

Some farmers have mistaken the directions to dissolve the drug in water and give 2 oz. of the solution, and have given 2 oz. of the solid scales. This is a serious mistake, and is likely to have injurious rather than beneficial results on the stock so treated.

It is convenient here to summarize the full authoritative method of coping with iron-hunger in stock. The following is the official recommendation for farming-lands of the volcanic soil province classified as sandy silts and gravelly sands of the Rotorua County (see map published in the issue of this *Journal* for June last) :—

(1.) Farm more highly; get the plough in; compact the soil; grow plenty of winter feed; and save plenty of hay. Subdivide into smaller paddocks, and keep the pastures eaten short. Top-dress with phosphate—preferably containing iron or in conjunction with iron sulphate—as frequently as is the practice to top-dress in the Waikato. Treat the stock well, especially in the matter of water-supply.

(2.) Use molasses freely in the feeding, especially in rearing young stock. Regard molasses as a preventive, but not as a cure.

(3.) When an animal shows signs of going back in condition owing to iron-hunger, give iron-ammonium citrate as supplied by the Mamaku Demonstration Farm, and by the Stock Inspectors at Rotorua and Tauranga, at cost price to *bona fide* farmers.

(4.) Buy any stock required from districts remote from the affected pumice land, and under conditions which ensure that the animals are free from disease or parasitic infection. Lack of the mineral elements is known to predispose an animal to other diseases and ailments, which, when introduced on to a farm on sick country, run a rapid course in the stock.

PASTURE TOP-DRESSING AT TE KUMI.

FIFTH YEAR'S EXPERIMENTAL RESULTS.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, Auckland.

THE permanent-pasture plots at Te Kumi were not top-dressed in 1925. During the preceding four years the plots received annual dressings of phosphatic fertilizers at the rate of 3 cwt. per acre. On the unlimed areas, plots with dressings of superphosphate have been tried alongside plots receiving dressings of basic slag and others dressed with ground raw rock phosphate (Nauru-Ocean). On an adjoining area, which was limed at the beginning of the experiment five years ago, plots were dressed with superphosphate side by side with plots treated with ground rock phosphate.

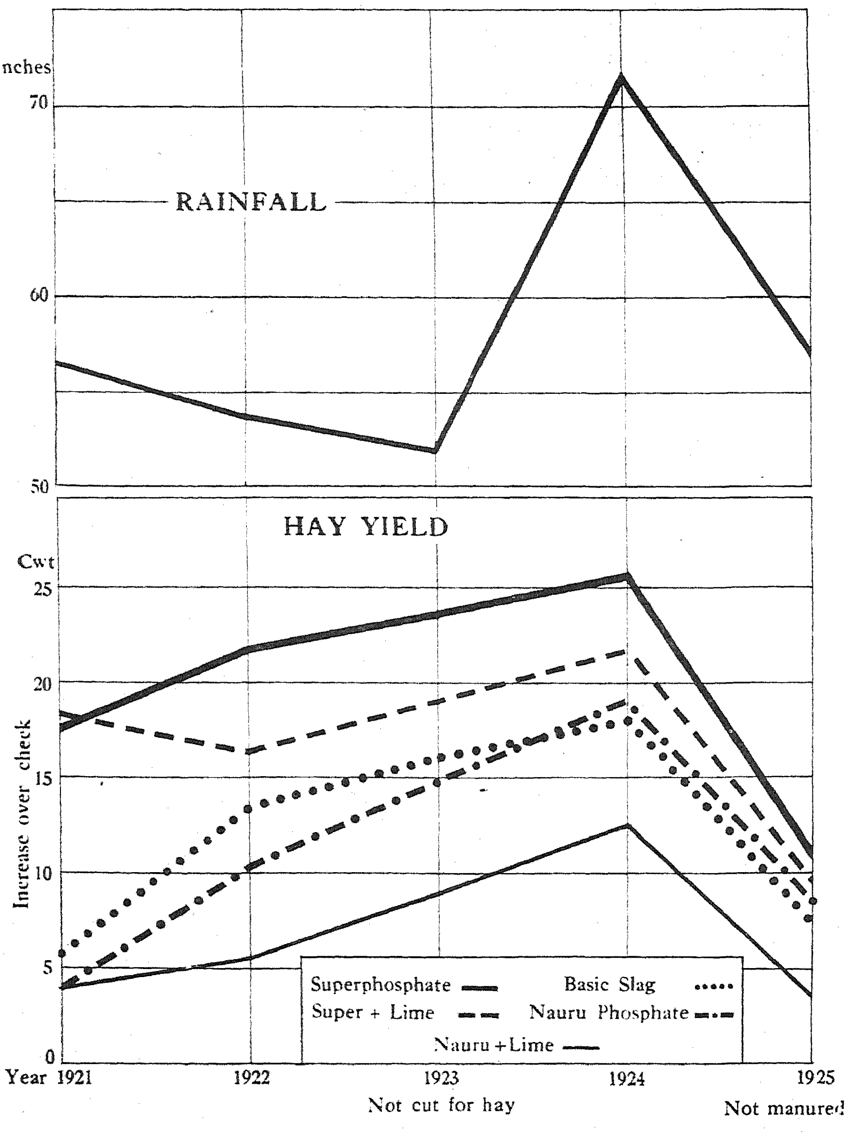
The object of omitting top-dressing last season was to test the lasting-values of the various fertilizers used. The opinion is widely held that while basic slag and ground rock phosphate are slower in action than superphosphate their lasting-qualities are better. The table below gives the weights of hay cut from the plots. Cutting and weighing were done between 4th and 7th January, 1926.

Fertilizer used.	Amount per Acre.	Hay-yield per Acre.	Increase over Check per Acre.	Percentage Increase on Check.
Unlimed Plots.		Cwt.	Cwt.	
Check	No manure ..	13·2	..	..
Basic slag	3 cwt. ..	20·3	7·4	56
Superphosphate	3 ,, ..	24·2	11·0	83
Rock phosphate	3 ,, ..	21·3	8·1	61
Limed Plots.				
Superphosphate	3 ,, ..	22·6	9·4	71
Rock phosphate	3 ,, ..	16·7	3·5	26

Rainfall for 1925, 57·05 in. (average 60 in.). Number of rainy days, 160.

Comparing the yields of hay on the whole of the plots with those of the preceding seasons, the yields were low. This result is no doubt due in a large measure to the unfavourable season, as hay-yields throughout the district were generally below the average. The spring was wet, and cold westerly winds were fairly constant until the end of November, when the weather set in dry and warm. This, combined with the fact that the annual dressing of fertilizers was omitted, would account mainly for the lowered yields. The comparatively heavy yield of hay cut in 1924 may also have had a tendency to lower the yield in 1925.

The accompanying graph covers the whole period of the trials. It provides a useful means of making comparisons, not only between the individual treatments, but the yearly increases in hay-weights over and above the natural yield, which is taken from the check plots.



GRAPH SHOWING FIVE YEARS' RESULTS OF TE KUMI TOP-DRESSING TRIALS.

IMPROVEMENT IN PASTURE.

A visual inspection of the pasture on the different plots was made before haying, and the following notes were recorded :—

Super and lime : Good, dense sward, of good colour ; vigorous cocksfoot, and bottom growth of suckling-clover and dogstail. Considered best quality.

Nauru and lime : Very weak generally, with many weeds ; the appearance of fern showed lack of vigour in better grasses.

Super : Fairly good sward ; suckling-clover and dogstail forming the bottom, rye-grass and fog the top—the fog rather prominent.

Nauru : Pasture poor, with many weeds, except Plot 4, which was a great improvement, having red clover and timothy growing vigorously. Weeds present include soft brome, fog, and tarweed.

Check : Very poor, with fern increasing. Herbage very withered and brown ; chiefly fog, soft brome, linum, cudweed, and dandelion.

Slag : Fairly good bottom growth, of good colour ; chiefly white clover and dogstail, with small amounts of red clover and cocksfoot ; rib-grass, tarweed, and suckling-clover also present.

All plots contained large amounts of tarweed and a good deal of fog.

POINTS IN THE RESULTS.

The plots are in triplicate, and since the experiment has been repeated year after year for five years on the same ground we have repetition in time as well as on the field. Having the results of previous seasons as a guide it seems feasible that the differences in yield on the plots which are comparable are real. An examination of the yields and the graph indicates that superphosphate, both on the limed and unlimed plots, maintains its lead over the other manures. So far as last season's results go at Te Kumi, the evidence shows that the lasting benefit of superphosphate in the soil is not less than that of the other phosphates. This fact is one of the most interesting that emerges from the data available for the season, and experiments to test this point further would be worth while.

Arrangements have been made with the owner of the farm, Mr. Charles Harrison, to go on repeating the dressings of phosphates and cutting the plots for hay as opportunity offers. It is thought that, as the plots are large enough to impress farmers, and the seasonal factor can be taken into account when weighings are made from the same ground for a number of years, experiments should be continued further.

In the grazing of lucerne care has to be taken that the crowns of the plant are not eaten out. A large number of stock should be turned in for a short period and the crop fed down rapidly. It should then be closed up until ready for another grazing. Continuous grazing should be avoided, as it lessens the life of the stand.

The mole drain-plough is most economical for certain types of clay land. When this method is employed the drains are usually spaced from 6 ft. to 9 ft. apart.

TWO RECENT CASES OF PLANT POISONING AMONG STOCK.

STRATHMORE WEED AND NGAIO.

W. M. WEBSTER, B.Sc., M.R.C.V.S., Departmental Veterinarian, Masterton.

THE writer has recently had an opportunity of investigating cases of poisoning of stock by two of the less generally known indigenous poisonous plants of New Zealand, and the following account is published with a dual purpose: firstly, to put on record as complete a history as possible of the symptoms and progress of the cases; secondly, to put the stockowner on his guard against the plants in question, and to aid him, through a recognition of the symptoms, in determining the source of trouble should a similar outbreak occur among his stock.

Strathmore Weed (Pimelia prostrata).

The first outbreak, which was brought under my notice by Mr. S. Fletcher, B.V.Sc., of Masterton, to whom I am also indebted for many of the clinical notes in this record, was due to the plant *Pimelia prostrata*, commonly known in the North Island as "Strathmore weed."

Pimelia prostrata is a small, creeping, shrubby plant with woody stems, belonging to the Thymelaeaceae or daphne family. The small oblong leaves tend to cluster at the terminal ends of the branches; flowers white, four-petalled, and waxen in appearance; berries round, white, and waxen, rather larger than a pin's head. If the stalk is chewed it produces after a short period a burning sensation in the mouth, which persists for some time. The plant is quite common, especially in rougher country. (A full botanical description is given in Cheeseman's "Manual of the New Zealand Flora," 1925.)

The first published record of its poisonous properties was contained in this Department's Leaflet for Farmers, No. 55, cases having occurred among coach-horses in Taranaki in 1900. Then, in 1908, cases among draught horses in the Wairarapa district were reported by the *Dominion* of 4th September.

In the present instance, in the Wairarapa, three draught horses were affected. The animals were usually housed and stall-fed, but two days prior to the symptoms being first noted had been camped in a paddock in which there was growing a fair amount of *Pimelia prostrata*, where they were dry-fed from a trough but allowed to graze.

When first seen one animal ("A"), which subsequently died, showed symptoms of severe colicky pains. There was in all three cases profuse watery diarrhœa, without any trace of blood or mucous, marked depression, loss of appetite, and a strong disinclination to move about; pulse full, but slower than normal, and temperature normal.

On the following day all exhibited intense inflammation and soreness of the mucous membranes of the mouth and tongue, and showed a distinct objection to being handled about these parts. The diarrhœa was more copious and watery, depression and stiffness very marked, and temperature slightly subnormal in all cases.

Two days later all three animals still exhibited the same symptoms—profuse watery diarrhœa, depression, disinclination to move, and soreness of the mouth. In addition, the nictitating membrane or "haw" and conjunctiva of the eye were more or less œdematous and distinctly icteric or yellow, but with a greyish tint as well. This phenomenon was most marked in "A," in which the protruded haw showed several distinct facets—a most unusual appearance. The pulse was thready and difficult to detect in this case; temperature, 97·5° F. There was also marked muscular soreness, especially of the loins and hind limbs, which did not tend to pass off with forced exercise. "B" showed the faceted and icteric condition of the haw to a lesser extent; depression again very marked, temperature subnormal, but pulse much fuller. "C" agreed with "B," save that the depression was not quite so marked, and swelling was not present in the membranes of the eye, which were, however, injected and distinctly icteric.

On the fifth day there was considerable diminution of the symptoms in "B" and "C," diarrhœa being almost checked, pulse and temperature normal, eye improved, mouth not so sore. "A," on the other hand, had grown steadily worse, the pulse being almost imperceptible, muscular soreness and depression increased, and temperature still subnormal.

On the following day "A" died; "B" and "C" made an uninterrupted recovery.

A *post mortem* examination on "A" yielded the following: The mucous membrane of the mouth and tongue showed a number of lesions, chiefly on the under-surface of the latter, and varying from small vesicles to circumscribed ulcers, with complete destruction of the epithelium. The whole of the mucous surface was distinctly yellow in tint and acutely inflamed.* The mucous membrane of the œsophagus or "gullet" showed a patchy injection, giving it a marbled appearance. The lesions of the mouth were repeated in the stomach. In this organ they were confined to the œsophageal portion, and were most marked and numerous in the region of the junction of the œsophageal and glandular parts of the stomach. Along this line the ulceration was more or less continuous and irregular, and in most cases the necrotic membrane—almost black in colour—was still semi-adherent to the underlying tissues. The glandular portion of the stomach was slightly congested, but otherwise unaffected. The intestines showed many injected areas, but no marked lesions. There was an area of consolidation in the posterior lobe of the right lung. The liver was undergoing fatty degeneration, and was also icteric, being pale yellow in colour. The internal appearance of the carcase generally was not so icteric as was expected, considering the condition of the visible mucous membranes.

From the foregoing it appears that the toxic action of *Pimelia prostrata* is that of an intense irritant poison, but apparently it does not cause acute pain, because it exerts some narcotic effect in addition.†

* *Cf.* B. C. Aston, F.I.C., F.N.Z.Inst., in "The Poisonous, Suspected, and Medicinal Plants of New Zealand," *N.Z. Journal of Agriculture*, vol. 26, p. 149: (1) "The burning sensation produced in the mouth when the plant is chewed"; (2) " . . . the fresh bark of daphne applied to the skin produces inflammation followed by vesication . . ."

† *Cf.* (1) B. C. Aston, *l.c.*, " . . . the symptoms of daphne poisoning are severe purging, burning of the mouth and throat, and in severe cases narcotic effects"; (2) G. L. Lander, in "Veterinary Toxology," 1912, p. 257: " . . . the physiological effect . . . also exhibits marked nervous effects . . . the animal is drowsy . . ."

Treatment consisted of a stimulant and a purgative dose of linseed-oil in the first instance, followed by linseed-tea, Bismuthi carb., and strong coffee in liberal doses at four-hour intervals.

It may be added that the plant is apparently only dangerous to animals unused to it, as horses have continually grazed for years in the paddock in question without any ill effects. Whether they avoid the plant or become tolerant of its action is not definitely known.*

Since the foregoing another case has occurred in the same district, exhibiting similar symptoms, and with fatal results.

Ngaio (Myoporum laetum).

The second poisonous plant to which this record refers is the ngaio, or *Myoporum laetum*, common in coastal districts. It is a low-growing tree, much branched, having long, lanceolate, fleshy leaves, giving off a pungent aromatic odour when bruised ; small, white, purple-spotted flowers, and small, oval, reddish-purple berries. (For a full botanical description see Cheeseman's "Manual of the New Zealand Flora.")

Previous cases of poisoning by this agent have been reported in May, 1910, August, 1912, and May, 1918.† The present instance occurred in south Wairarapa. Out of a bunch of thirteen two-and-a-half-year-old Hereford steers in good condition, and running in a 30-acre paddock containing an abundance of feed, three were found dead and two seriously ill. The paddock contained a number of ngaio and beech trees for shelter. A week previous to the outbreak a large limb of a ngaio, heavily laden with berries, had come down during a gale of wind, and there was ample evidence that a considerable quantity of the berries, leaves, and terminal twigs had been eaten.

The three dead animals were all lying as if resting, without the slightest indication of any *ante mortem* struggle.

On *post mortem* examination the rumen or "paunch" was found in each case fully packed with grass, but only in one case was a recognizable fragment of ngaio-leaves and a few berries found. The reticulum or "honeycomb" appeared normal in each case In each the omasum or "manyplies" was perhaps unduly distended, but the ingesta was normal in appearance. The many folds of mucous membrane, however, were injected, the capillaries being all engorged with blood and standing out in a remarkable manner. The abomasum or "fourth stomach" contained a small proportion of ingesta mixed with a considerable quantity of extravasated blood. The lining membrane was intensely inflamed, while the walls were thickened and congested. In each case, among the semi-fluid ingesta, the hard seeds of the ngaio-berries, unbroken and unaltered by the process of digestion, were present in large numbers, so numerous as to preclude any attempt at a count being made. The remainder of the intestinal tracts exhibited the same intense inflammation and congestion, and were empty save for small amounts of dark bloody exudate. The rectum in each instance contained a few small, hard, mucous-coated pellets largely composed of blood-clot. The kidneys appeared in a state of acute congestion, and

* *Cf.* Leaflet for Farmers, No. 55, N.Z. Department of Agriculture, 1900: " . . . that the weed is very injurious to strange horses, and that, as a rule, after they eat it once and recover they do not touch it again . . ."

† B. C. Aston, *l.c.*

the bladder in all three cases contained a considerable quantity of urine of a characteristic deep-golden-orange colour. The hearts were unusually flabby and dilated. The remaining organs appeared normal.

The two bullocks still alive were lying about dull and listless, not feeding or cudding, but able to move off briskly when disturbed, without any loss of muscular control. Both were apparently suffering from acute constipation, as, despite a careful search, no trace of any recently voided dung could be found.

The most characteristic symptom observed in these animals was the extremely tucked-up appearance of the abdomen. The oblique abdominal muscles were fully tensed, so as to make the posterior border of the ribs stand out very distinctly (the so-called "pleuritic line"). This is indicative of acute abdominal pain, as would be expected from the *post mortem* findings in the dead animals.

As they were run cattle no closer examination could be made save in a crush, and this course was deemed inadvisable. For a similar reason no treatment was adopted, though demulcents and stimulants appeared indicated. Both animals recovered completely in the course of eight or nine days.

The symptoms of extreme constipation and colicky pains are in agreement with those described in previous outbreaks,* but the latter all occurred in late autumn and winter when other keep was scanty, and the paunches were in each instance packed with ngaio leaves and twigs. At this period of the year, too, the berries are absent. From the present cases—occurring early in March—and the severity of the symptoms it would appear that the berries and seeds are much more drastic in their toxic action and more intensely irritant in their effect than are the leaves and twigs by themselves. Further, from the absence of any evidence of struggle immediately prior to death, especially in view of the state of the internal organs as revealed in the *post mortem* examination, it would seem that ngaio also exercises powerful effects of a narcotic nature on the nervous system.

* B. C. Aston, *l.c.*

Handling of Stock in Transit to Freezing-works.—The annual report of the Meat-producers' Board for 1925–26 has the following remarks on this subject: "On various occasions the Board has pointed out to farmers and others the importance of the careful handling of live-stock whilst in transit to freezing-works, and, through the courtesy of the Railway authorities, it has had posters permanently displayed at all trucking-stations giving warning of the damage that occurs to stock through careless handling. As a result of a recent visit to different freezing-works the general manager has reported to the Board that there is still a great economic waste taking place owing to the bruised condition of stock arriving at the works. Many farmers are often concerned at the large percentage of second-class lambs as returned by the freezing companies, and are not aware that a great many of these lambs are placed in the second grade owing to bruises. A certain amount of this bruising occurs in railway-trucks, but, nevertheless, a great deal takes place before the lambs are railed and during trucking. In analysing the nature of these bruises there appears to be a lot of it caused through wool-pulls — that is, catching hold of the animal by the wool. It is essential that farmers should see that every care is given to the handling of their stock whilst *en route* to freezing-works. The monetary loss which occurs through bruising is very considerable, besides the bruising being detrimental to the appearance of our lambs when displayed on Smithfield."

WHEAT MANURIAL EXPERIMENTS IN CANTERBURY, SEASON 1925-26.

A. W. HUDSON, B.Sc., B.Ag., Instructor in Agriculture, Christchurch.

IN continuation of the wheat manurial experiments the results of which were published in this *Journal* for April, 1925, further work was carried out in the same district in the 1925–26 season. Certain modifications in the fertilizer mixtures used were made, and other quantities and treatments were added.

Blood, which hitherto had been used at the low rate of ½ cwt. per acre with no significant effect, was increased in quantity to 1 cwt. per acre. Thus some 12 lb. to 13 lb. of nitrogen per acre was supplied. Potash in the form of sulphate, and an increased amount of phosphates, were also tried. The diversity of results is considerable, and each experiment will therefore be discussed separately.

It was intended that all experiments should be on autumn- or winter-sown wheats as in the past, but the season proved to be such an extraordinarily wet one that sowings of two of the experiments had to be left until the spring. The methods adopted for the sowing, harvesting, and threshing of crops were described in last month's issue of the *Journal*.

NOTE.—In various places in the tabular statements presented it will be noticed that different yields are shown for the same treatment in a particular experiment. This is due to the fact that the mean has been calculated from different combinations or from different numbers of plots. In making comparisons care has been taken to pair plots which were most closely situated to one another.

EXPERIMENT I, ON FARM OF J. FOSTER, LADBROOK'S.

These plots were sown on 20th May, 1925, and harvested on 2nd February, 1926; variety, College Hunter's; seeding, 1½ bushels per acre. The experiment was carried out in the same field as that used the previous year. The history of the field was—wheat in 1924–25, and grass for three years prior to that crop.

The treatments per acre were—

(1.)	Control (no manure).	
(2.)	Superphosphate, 42/44 per cent. tricalcic phosphate ..	1 cwt.
(3.)	Superphosphate, 42/44 per cent.	2 cwt.
(4.)	Basic super, 40/43 per cent.	1 cwt.
(5.)	Basic super, 40/43 per cent.	2 cwt.
(6.)	Basic super, 1 cwt., plus dried blood, 1 cwt.	2 cwt.
(7.)	Super, 1 cwt., plus dried blood, 1 cwt.	2 cwt.
(8.)	No. 7 mixture, plus ½ cwt. sulphate of potash	2½ cwt.

Six replications of this series were sown, all plots being 3 chains in length. The division into two at harvest gave twelve determinations of yield of each treatment, the mean of the differences between paired plots being calculated. This area suffered badly in the winter months, patches being almost drowned out; hence variation in the yield of plots of the same treatment was considerable, increasing the difficulty of arriving at conclusive results.

NOTE.—Two extra plots sown with super at the rate of 1 cwt. per acre were included in each series. These were to be used as a "way" for the binder in the event of delayed ripening of controls, which would have been cut when ripe. No appreciable differences in ripening occurred, so that the plots were actually used for yield determination.

Observations during Growth.

9th September, 1925: All manured plots showed a marked superiority in growth over controls. Basic super, 1 cwt., plots were the poorest of the manures, and super at 2 cwt., super plus blood, and super plus blood plus potash were the most strongly grown.

15th October: Growth of controls still inferior, but colour much deeper than manured plots, which had a yellowish tinge. The whole were very uneven on account of extremely wet conditions.

12th January, 1926: All plots very weedy, and differences not determinable with any degree of certainty.

Comparisons which have been made are shown in Table 1.

Table 1.—Results of Experiment 1.

Number of replications, 6 (except super, 1 cwt. per acre). Each plot divided into two. Area of individual plot, $\frac{1}{107\cdot7}$ acre. > = greater than.

	Comparison, A *versus* B.	Number of Paired Plots.	Yield per Acre.	Difference in Favour of A.	Odds.	Remarks.
			Bushels.	Bushels.		
A.	Super, 1 cwt. ..	15	38·3	4·4	>9999	Difference significant.
B.	Control.. ..	..	33·9			
A.	Basic super, 1 cwt.	11	34·7	1·0	4	Difference not significant.
B.	Control.. ..	..	33·7			
A.	Super, 2 cwt. ..	12	36·8	0·8	3·6	Difference not significant.
B.	Super, 1 cwt. ..	..	36·0			
A.	Basic super, 2 cwt.	12	38·6	3·7	1666	Difference significant.
B.	Basic super, 1 cwt.	..	34·9			
A.	Super, 1 cwt. ..	12	36·0	1·1	3·6	Difference not significant.
B.	Basic super, 1 cwt.	..	34·9			
A.	Basic super, 2 cwt.	12	38·5	1·7	7	Difference not significant.
B.	Super, 2 cwt. ..	..	36·8			
A.	Basic super, 1 cwt., + blood, 1 cwt.	12	40·5	5·6	1700	Difference significant.
B.	Basic super, 1 cwt.	..	34·9			
A.	Super, 1 cwt., + blood, 1 cwt.	12	39·1	1·3	2·8	Difference not significant.
B.	Super, 1 cwt. ..	..	37·8			
A.	Super, 1 cwt., + blood, 1 cwt., + potash, ½ cwt.	12	41·8	2·7	27	Difference barely significant.
B.	Super, 1 cwt., + blood, 1 cwt.	..	39·1			

Readers are reminded that where the odds shown in column 5 are less than 30 to 1 the difference is not regarded as a real one.

NOTE.—Prices of manures per ton at country stations for 1925 were: Super, 42/44, £7; basic super, £6 10s.; dried blood, £14; sulphate of potash, £19. In evaluation of increase 5s. per bushel is taken as the value of wheat.

Comments on Table 1.

(1.) Super at the rate of 1 cwt. per acre shows an increase of approximately $4\frac{1}{2}$ bushels per acre over control. At 5s. per bushel this is worth £1 2s. 6d., and is obtained at a cost of 7s; hence the profit per acre is about 15s. 6d. In the previous season super on this paddock gave an increase of nearly $6\frac{1}{2}$ bushels per acre.

(2.) Basic super at the rate of 1 cwt. per acre shows an increase of only 1 bushel per acre, which is not a statistically significant one. In view of the result from super this small difference is probably a real one, but is too small to be regarded as profitable.

(3.) The addition of the second hundredweight of super has not given a significant increase over the first.

(4.) The 2 cwt. quantity of basic super has increased the yield over that of 1 cwt. of the same manure by a considerable amount—3·7 bushels per acre. Allowing that the 1 cwt. increase of 1 bushel over control is significant, the second hundredweight will show an increase over control of 4·7 bushels per acre. This is profitable, but not to the same extent as 1 cwt. of super.

(5.) The superiority of super, 1 cwt., over basic super, 1 cwt., is not significant.

(6.) The superiority of 2 cwt. basic super over 2 cwt. super is not significant.

(7.) 1 cwt. of blood added to 1 cwt. of basic super has caused an increase of approximately $5\frac{1}{2}$ bushels per acre, the value of which is £1 7s. 6d., and the cost of blood 14s. A profit of 13s. 6d. per acre results.

(8.) The addition of blood to superphosphate has not resulted in a certain increase.

(9.) The chances of 27 to 1 in favour of $\frac{1}{2}$ cwt. of sulphate of potash causing an increase of 2·7 bushels per acre give very nearly practical certainty, but if the increase is real it is profitable to the extent of only 4s. per acre.

As already indicated, the great variation of the crop due to drowning makes the results difficult of interpretation.

EXPERIMENT 2, ON FARM OF F. W. CARPENTER, PREBBLETON.

Dates sown, 1st and 6th June, 1925; date harvested, 1st February, 1926; variety, Solid-straw Tuscan; seeding, $1\frac{3}{4}$ bushels per acre. History of the paddock: 1924–25, wheat; 1923–24, oats; 1922–23, potatoes. Prior to 1922 the ground was in grass for six years, and for a period had been used as a pig-paddock.

The treatments were as detailed for the previous (Ladbrook's) experiment. Hard experience has here provided us with a valuable

lesson in the matter of sowing under uniform conditions. The control, 1 cwt. super, and 2 cwt. super plots were sown on 1st June. The work was not completed on that day, and the intervention of rain prevented sowing of the remainder of the plots until 6th June. Irregularities, which cannot be attributed to anything else than this difference in time of sowing, are evident, and are discussed below. Comparisons have been made only between treatments sown on the same day, and are shown in Table 2.

Table 2.—Results of Experiment 2.

Number of replications, 10. Plots not subdivided. Area of individual plot, $\frac{1}{111 \cdot 1}$ acre.

Comparison, A *versus* B.	Number of Paired Plots.	Yield per Acre.	Difference in Favour of A.	Odds.	Remarks.
		(A.) *Plots sown 1/6/26.*			
		Bushels.	Bushels.		
A. Super, 1 cwt. ..	15	48·8	1·1	40	Difference significant.
B. Control.. ..	..	47·7			
A. Super, 1 cwt. ..	10	48·1	1·5	32	Difference significant.
B. Super, 2 cwt. ..	..	46·6			
		(B.) *Plots sown 6/6/26.*			
A. Basic super, 2 cwt.	10	45·2	0·7	4	Difference not significant.
B. Basic super, 1 cwt.	..	44·5			
A. Basic super, 1 cwt., + blood, 1 cwt.	10	48·6	4·1	132	Difference significant.
B. Basic super ..	..	44·5			
A. Super, 1 cwt., + blood, 1 cwt.	8	49·1	0·3	1·5	Difference not significant.
B. Super, 1 cwt., + blood, 1 cwt., + potash, ½ cwt.	..	48·8			

Comments on Table 2.

The table is divided into two parts—the comparison of plots sown (A) on 1st June, and (B) those sown on 6th. It is not likely that the actual time in difference of sowing was of consequence, but what is probable is that the difference in the condition of the soil was a disturbing factor. On examination it was found that the basic super 1-cwt.-per-acre plots gave a significantly lower yield than control. The truth of this is so improbable that it must be concluded that the difference in the sowing-conditions had an influence.

Section A, plots sown 1/6/26: (1.) 1 cwt. super shows an unprofitable but significant increase of 1 bushel per acre. Differences between treatments sown on the same day were never evident.

(2.) Super, 2 cwt., actually shows a depression in yield as compared with super, 1 cwt. This is difficult to account for.

Section B, plots sown 6/6/26: (1.) Basic super at 2 cwt. per acre has given no certain increase over the 1 cwt. quantity.

(2.) The addition of 1 cwt. blood to 1 cwt. basic super has caused an increase of just over 4 bushels per acre, and a resulting profit of about 6s. 6d.

(3.) The addition of sulphate of potash to the super-and-blood mixture has proved a dead loss.

It is interesting to notice that super and blood applied on 6th June gave a yield of 49·1 bushels per acre. If this treatment had been adversely affected by the conditions of later sowing, as it is surmised the basic super was, then it might be expected that the super-and-blood combination and its potash addition mixture would have yielded about 52 bushels per acre. This is mere supposition, and, unfortunately, it is impossible to test its validity.

EXPERIMENT 3, ON FARM OF W. AND A. CAMPION, PREBBLETON.

Date sown, 3rd October, 1925; date harvested, 26th July, 1926; variety, Solid-straw Tuscan; seeding, 2 bushels per acre. History of paddock: 1924–25, potatoes, preceded by winter fallow and three years of grass.

The treatments were as for the preceding experiments, with the exception that the basic-super-plus-blood mixture was not included.

Observations during Growth.

The area was visited on 12th January, 1926, and the superiority of manured plots over the controls was very evident. Basic super at 1 cwt. per acre was the poorest of the manured plots in appearance, the super plus blood and super plus blood plus potash being the best. All others (super, 2 cwt.; super, 1 cwt.; and basic super, 2 cwt.) appeared to be about equal.

Comments on Table 3.

The interpretation of results from the spring-sown crops is much more satisfactory and conclusive:—

(1.) 1 cwt. super has caused an increase of nearly 3½ bushels per acre, the value of which is 17s., and the net profit resulting equals 10s. per acre.

(2.) The same quantity of basic super shows a profit of only 3s. per acre resulting from its use.

(3.) 2 cwt. super gave a 2·1-bushel-per-acre increase over the 1 cwt. quantity, and a consequent further profit of 3s. 6d.

(4.) The second hundredweight of basic super gave no statistically significant increase over the 1 cwt. quantity, although the chances of 21 to 1 are approaching practical certainty. In any case the increase is not a profitable one.

(5.) 1 cwt. super has proved decidedly better than 1 cwt. basic super.

(6.) Similarly, 2 cwt. super has proved superior to 2 cwt. basic super.

(7.) 1 cwt. blood, although increasing the yield when added to super by approximately 1½ bushels per acre, has not been a profitable application.

(8.) ½ cwt. sulphate of potash has had no beneficial effect.

Table 3.—Results of Experiment 3.

Number of replications, 7. Each plot divided into three. Area of individual plot, $\frac{1}{58 \cdot 7}$ acre.

	Comparison, A *versus* B.	Number of Paired Plots.	Yield per Acre.	Difference in Favour of A.	Odds.	Remarks.
			Bushels.	Bushels.		
A.	Super, 1 cwt. ..	21	32·1	3·4	>9999	Difference significant.
B.	Control.. ..	..	28·7			
A.	Basic super, 1 cwt.	21	30·6	1·9	384	Difference significant.
B.	Control.. ..	..	28·7			
A.	Super, 2 cwt. ..	21	34·2	2·1	>9999	Difference significant.
B.	Super, 1 cwt. ..	..	32·1			
A.	Basic super, 2 cwt.	21	31·3	0·7	21	Difference not significant.
B.	Basic super, 1 cwt.	..	30·6			
A.	Super, 1 cwt. ..	21	32·1	1·5	800	Difference significant.
B.	Basic super, 1 cwt.	..	30·6			
A.	Super, 2 cwt. ..	21	34·2	2·9	>9999	Difference significant.
B.	Basic super, 2 cwt.	..	31·3			
A.	Super, 1 cwt., + blood, 1 cwt.	21	33·7	1·6	384	..
B.	Super, 1 cwt. ..	..	32·1			
A.	Super, 1 cwt., + blood, 1 cwt.	21	33·7	0·6	9	Difference not significant.
B.	Super, 1 cwt., + blood, 1 cwt., + potash, ½ cwt.	..	33·1			

EXPERIMENT 4, ON FARM OF F. W. CARPENTER, PREBBLETON.

Date sown, 6th August, 1925; date harvested, 8th February, 1926; variety, Solid-straw Tuscan; seeding, 1¾ bushels per acre. Preceding crop, Italian rye-grass.

The manurial treatments per acre were as follows:—

(1.) Control.
(2.) Super (42/44 per cent.), 1 cwt.
(3.) Super, 1 cwt., plus sulphate of potash (48 per cent. K_2O), ½ cwt.
(4.) Super, 1 cwt., plus dried blood, 1 cwt.
(5.) Super, 1 cwt., plus nitrate of soda, 176 lb.
(6.) Super, 1 cwt., plus nitrate of soda, 93 lb.
(7.) Super, 1 cwt., plus sulphate of ammonia, 83 lb.
(8.) Super, 1 cwt., plus sulphate of ammonia, 71 lb., plus sulphate of potash, ½ cwt.

The super was sown with the grain in each plot, as also was the dried blood and sulphate of potash (Plots 3 and 4). All nitrate of soda, sulphate of ammonia, and the sulphate of potash on Plot 8 were top-dressed on 25th September, about seven weeks after sowing of seed. With the exception of Plot 5, which received nitrate of soda at the rate of 176 lb. per acre, it was intended that the amount of nitrogen supplied

in the form of nitrate of soda and sulphate of ammonia should equal that contained in 1 cwt. of blood—85 lb. of the former and 67 lb. of the latter would supply the desired amount. Difficulty was experienced in getting the material to run freely, and the exact quantities were not sown (see schedule of manures above).

Observations during Growth.

On 15th October, 1925, about ten weeks after sowing, the control plots were decidedly inferior to all manured plots, and the super and blood was quite the best plot.

On 25th October the effect of the nitrogen was much in evidence on all plots, but especially on those which received the heavy dressing of 176 lb. of nitrate of soda. The greater growth and deeper green colour of the nitrogen plots were maintained until the crop ripened. The plots receiving super alone and super and potash, although superior to the controls in growth for a considerable time, were hardly distinguishable from them at harvest-time.

Comments on Table 4.

NOTE.—Nitrate of soda, £20 per ton, 15·5 per cent. nitrogen approximately; sulphate of ammonia, £22 per ton, 20 per cent. nitrogen approximately; dried blood, £14 per ton, 12 per cent. nitrogen approximately.

(1.) 1 cwt. super has caused a significant but unprofitable increase of 1 bushel per acre. This result proved unexpected, as the evident superiority of the super plots in the earlier stages indicated a considerable increase in yield.

(2.) ½ cwt. sulphate of potash added to the super has had no effect on yield.

(3.) 1 cwt. blood added to the phosphate has caused a profitable increase of 5·2 bushels per acre.

(4.) Nitrate of soda applied at the rate of 176 lb. per acre shows a net return of 16s. 6d. per acre.

(5.) Nitrate of soda at 93 lb. per acre has caused an increase of 5·9 bushels, and a net profit of about 13s. per acre.

(6.) Sulphate of ammonia at 83 lb. per acre has been profitable to the extent of about 9s. per acre.

(7.) The addition of ½ cwt. sulphate of potash has not been profitable. The depression in yield below that of super and sulphate of ammonia may be due to the lesser quantity (12 lb.) of sulphate of ammonia. On the other hand, the potash may have been responsible for the depression.

(8.) The comparison of the two quantities of nitrate of soda is to the disadvantage of the heavier quantity, the increase of 2·6 bushels of wheat not being sufficient to pay for the extra 83 lb. of nitrate. (In comparison above it will be noticed that the mean of 1-cwt.-super-per-acre plots, with which the 176 lb. quantity of nitrate of soda is compared, is considerably lower than the mean of those with which the 93 lb. of nitrate of soda is compared.)

(9.) Both nitrate of soda and sulphate of ammonia show a considerably better yield than does blood when a direct comparison is made.

(10.) The quantity of nitrogen supplied in the soluble salts is slightly higher than that in blood. It seems unlikely that this small difference would be wholly responsible for the difference in yield. The time of application and greater availability of the soluble salts are more likely to be responsible.

Table 4.—Results of Experiment 4.

Number of replications, 10. Each plot divided into two. Area of individual plot, 1/[illegible] acre. All plots received super at 1 cwt. per acre.

Comparison, A *versus* B.	Number of Paired Plots.	Yield per Acre.	Difference in Favour of A.	Odds.	Remarks.
		Bushels.	Bushels.		
A. Super	30	27·8	1·0	130	Difference significant.
B. Control.. ..	..	26·8			
A. Super	20	26·4	..	..	Difference not significant.
B. Super, + potash, ½ cwt.	..	26·5			
A. Super, + blood, 1 cwt.	20	31·6	5·2	>9999	Difference significant.
B. Super	..	26·4			
A. Super, + nitrate of soda, 176 lb.	20	36·6	9·7	>9999	Difference significant.
B. Super	..	26·9			
A. Super, + nitrate of soda, 93 lb.	20	34·5	5·9	>9999	Difference significant.
B. Super	..	28·6			
A. Super, + sulphate of ammonia, 83 lb.	20	33·7	5·1	>9999	Difference significant.
B. Super	..	28·6			
A. Super, + sulphate of ammonia, 83 lb.	20	33·7	1·1	90	Difference significant.
B. Super, + sulphate of ammonia, 71 lb. + potash, ½ cwt.	..	32·6	..	..	Note slightly lower amount of sulphate of ammonia in B.
A. Super, + nitrate of soda, 176 lb.	18	36·8	2·6	>9999	Difference significant.
B. Super, + nitrate of soda, 93 lb.	..	34·2			
A. Super, + nitrate of soda, 93 lb.	20	34·5	2·9	>9999	Difference significant.
B. Super, + blood, 1 cwt.	..	31·6			
A. Super, + sulphate of ammonia, 83 lb.	20	33·8	2·2	832	Difference significant.
B. Super, + blood, 1 cwt.	..	31·6			

GENERAL CONCLUSIONS.

(1.) In the 1925–26 season phosphatic manures did not give the same marked response as in the preceding season, when the average increase due to 1 cwt. of super from six experiments was 7 bushels per acre. 1 cwt. of super has given decided increases in all four experiments, but on only two of these has its application been profitable.

(2.) On the whole, the application of 2 cwt. of phosphate has not been as profitable as 1 cwt.

(3.) Basic super has in no case proved superior to super, and in one case (Experiment 3, spring-sown) has been decidedly inferior.

(4.) In no case has ½ cwt. sulphate of potash added to phosphate been instrumental in increasing yield.

(5.) The addition of 1 cwt. dried blood to 1 cwt. phosphate has proved profitable in three cases out of five (as an addition to either super or basic super), and in the one experiment in which nitrate of soda and sulphate of ammonia were used both treatments have quite justified their application. This effect of nitrogen is contrary to popular belief, and in such an abnormal season the results are likely to be extraordinary. The winter was the wettest recorded for many years, and excessive leaching of nitrates must have resulted.

(6.) The diversity of results lends further emphasis to the necessity for experiments such as these being carried out for a number of seasons on particular classes of soil before any generalizations can be made.

ACKNOWLEDGMENTS.

The Department is indebted to those farmers on whose farms the work was conducted for their continued keen interest and assistance. To Messrs. Bates, Montgomery, Calder, Claridge, and Bryden, who at various times have assisted in these and other experiments which will be discussed later, thanks are due for the care and energy put into their work in the field and in the tedious compilation of results.

Lamb Export Trade.—The Meat-producers' Board report for 1925–26 remarks: "The greater demand for our lambs on the British market commences after Easter. Like all other markets, the British meat trade can absorb a certain amount of lamb in the off season, and early shipments of new season's lamb often realize good prices. But shippers and producers must recognize that the requirements of the Home trade must be carefully studied, and an oversupply of lambs before the lamb-eating season commences in Britain should be avoided. In observing the requirements of the Home market in this respect producers must also take into account the most economical time for the farming of the early lambs, having regard to the period when there is a greater abundance of feed."

Compensation for Stock and Meat condemned.—Compensation to the amount of £16,212 was paid out during the year 1925–26 for 5,747 animals condemned in the field for diseases under the Stock Act, and £14,671 for carcases or parts of carcases condemned for disease on examination at time of slaughter at abattoirs and meat-export slaughterhouses, &c., under the provisions of the Slaughtering and Inspection Act.

STAGE OF CUTTING COCKSFOOT FOR SEED.

R. J. VEALE, Canterbury Agricultural College, Lincoln.

COCKSFOOT-SEED cut on Banks Peninsula frequently has a germination lower than might reasonably be expected, and it has often been suggested that this is due to too early cutting. The probability that this is the case was emphasized by a statement made by one well acquainted with the business, to the effect that cocksfoot may be cut almost as soon as the anthers have fallen, because the seed will ripen in the straw.

A small experiment was therefore designed to see if the early cutting thus advocated had or had not a deleterious effect on the germination. A single strain of cocksfoot was taken and the seed-heads marked immediately all the anthers had fallen. These heads were cut at three different stages—namely, four, eight, and twelve days after the fall of the anthers. After the seed had ripened ready for threshing the heads from each stage of cutting were gathered and threshed separately. A month later the three samples of seed were tested for germination percentage. Five lots from each stage of cutting were taken, and the whole fifteen were germinated under the same conditions.

After twenty-one days in the germinator the results were as follows :—

Seed cut	4	days after anther-fall	germinated	$17 \pm 5\cdot5$	per cent.
,,	8	,,	,,	$28 \pm 5\cdot0$	,,
,,	12	,,	,,	$34 \pm 3\cdot9$	,,

This gives a difference of $17 \pm 6\cdot4$ per cent. in favour of the seed cut twelve days after the fall of the anthers as against that cut four days after.

The experiment was repeated with another strain of cocksfoot, with the following result :—

Seed cut	4	days after anther-fall	germinated	$13 \pm 1\cdot4$	per cent.
,,	8	,,	,,	$20 \pm 1\cdot6$	,,
,,	12	,,	,,	$33 \pm 2\cdot4$	,,

This gives a difference of $20 \pm 2\cdot7$ per cent. in favour of the twelve-day cutting as against cutting four days after the anthers fall.

It is clear that even twelve days after the anthers fall is too early to cut, and that the very early cutting sometimes recommended causes heavy losses in germinable seed.

The seed-heads that were cut twelve days after the fall of the anthers were just beginning to turn from green to brown, but it would have been another eight or twelve days after this stage before there was any danger of the seed falling out during cutting.

Before the bush was felled from the hills at Akaroa the cocksfoot was cut at a riper stage than that at which it is being cut at present, owing to there being then less danger of the seed shaking out with the wind ; but it seems that the early stage of cutting has been carried too far and has seriously affected the germination of the seed.

MARTON EXPERIMENTAL AREA.

NOTES ON OPERATIONS, SEASON 1925-26.

J. W. DEEM, Instructor in Agriculture, Wanganui.

THE weather conditions experienced during the past year in the Marton district have been exceptional. The winter of 1925 was wet but fairly mild; the spring was rough and wet, and seriously retarded the sowing of most crops. The early summer was dry, and consequently most of the crops made slow growth, which was fortunate in some ways, as January was exceptionally wet, and if the crops had been ready to harvest at the usual time they probably would have been badly damaged. The autumn, however, was dry, allowing nearly all the crops to be saved in very fair condition. Despite the difficult season, the returns from the area may be considered satisfactory.

Details of the year's rainfall are as follows:—

Table 1.

Month.	Number of Wet Days.	Month's Rainfall.	Average Rainfall, Fifteen Years.	Month.	Number of Wet Days	Month's Rainfall.	Average Rainfall, Fifteen Years.
1925.		Inches.	Inches.	1926.		Inches.	Inches.
July ..	14	2·45	3·72	January ..	15	6·91	3·04
August ..	18	3·07	2·98	February	14	3·77	2·30
September	16	6·31	3·47	March ..	11	2·47	2·51
October ..	17	2·04	4·72	April ..	9	1·37	2·21
November	10	3·26	4·16	May ..	24	7·86	3·26
December	5	1·46	3·27	June ..	13	2·69	3·82

From the table it will be noticed that during the past year the months of September, January, and May had a rainfall much in excess of the average fall for these months respectively, while December and April were well below the average.

The total area under crop during the past year was slightly less than in the preceding season, due to the sowing-down of 4 acres in brown-top, 5 acres in Lotus major, and 3 acres of white clover for further trials. The areas sown in the various crops were: Wheat, variety trial, 5 acres; oats, variety trial, 9 acres; Black Skinless barley, $2\frac{1}{2}$ acres; Early Minto peas, $2\frac{1}{4}$ acres; William Hurst peas, $\frac{3}{4}$ acre; Moumahaki vetches, 1 acre; and small plots of turnips, swedes, and maize. The remainder of the Area was down in pasture, lucerne, and white-clover plots. Top-dressing trials were carried out on the pastures and lucerne.

CROPS.

Wheat Variety Trials.—These trials were carried out in Field 6, the following varieties being grown: Queen Fan, Queen Fair, Turretfield Eclipse, Jumbuck, and Major. The plots, each an acre in area, were

sown on 16th October. Early growth was slow, but afterwards fairly good growth was made, and the wheats filled well. Rust was in evidence, but not very badly, and no variety seemed to be more heavily infected than any of the others. The Major variety was the only one showing smut in any amount. All the varieties ripened about the same time, but unevenly, and were cut about the middle of February, with the following results:—

Table 2.

Variety.	Yield, 1926.	Average Yield, Two Years.	Remarks.
	Bushels.	Bushels.	
Turretfield Eclipse ..	42	40	Good sample; strong straw; hardly touched by birds.
Jumbuck	38	40	Very nice sample; good straw; birds very severe.
Queen Fan ..	36	38½	A little smut; very fair sample.
Queen Fair ..	33½	38¾	Very similar to Queen Fan.
Major	31	..	Bad with smut; sample only fair; birds took a good deal.

It will be seen that Jumbuck and Turretfield Eclipse have the same average yield for two seasons. Jumbuck, however, is the better sample, and it is intended to sow a larger area of this wheat next year. The Turretfield Eclipse should be a good wheat to grow where birds or wind are usually limiting factors in the yield of wheat.

Black Skinless Barley.—This crop was sown on 21st October, and although the season was not the best for barley the very fair yield of 34 bushels per acre was obtained. This variety is becoming fairly popular in the surrounding districts as a green fodder crop, but not much was sown in the past autumn on account of dry weather.

Field-peas.—Early Minto and William Hurst peas were sown in Field 7 on 3rd November, but made slow growth until the New Year. The latter variety was affected with collar-rot, and only 5¼ bushels of seed could be saved. Early Minto, however, was a very fair crop, and yielded 37½ bushels per acre.

Vetches.—The Moumahaki vetches sown in the same field at the same time made very slow growth, and were so late in coming to maturity that they could not be cut until the middle of April. Wet weather from then on spoilt all chance of harvesting them, and they had to be ploughed under.

Algerian Oats for Chaff.—In Field 8, 2¼ acres each of Australian, College, North Island, and South Island Algerian oats were sown on 10th October as a trial for the best yield of chaff. It was not until January that they made any real growth, and when cut about the middle of February they were only a fair crop. When the different strains were growing there was no very pronounced difference in them, the College oats being a little better perhaps on account of their stooling quality. While standing in the stook it was noticeable that the College had the brightest and cleanest straw, and slightly fuller heads.

The various lots were harvested and stacked separately, cut for chaff, and the resulting chaff weighed, with the following results per

acre: College, 1·07 tons; South Island, 0·93 tons; North Island, 0·91 tons; Australian, 0·72 tons. The yield of the Australian oats was lowered slightly owing to one side of the plot being shaded by a belt of pine-trees, but even then they did not appear to be quite so good as the North Island strain.

Roots.—Small plots were also sown for various tests with swedes, soft turnips, and mangolds.

The swedes, with the exception of two Danish varieties, were from David Bell, Ltd., and all produced fairly good crops. A cold snap in April checked the aphis and moth just when they threatened to damage the crop. Club-root was noticed on one variety only, and that not very bad. The roots were pulled and weighed on 16th June, when several of each variety were cut open to test their keeping-qualities. Results were as follows:—

Table 3.

Variety.	Yield.		Condition.
	Tons	cwt.	
D.B. Improved Bronze-top ..	45	15	Quite sound, and nice quality.
D.B. Bell's Mervue	43	19	,, ,,
Wibollt's Giant Purple-top ..	41	19	Quite sound, and very fair quality.
D.B. Crimson King ..	41	4	Quite sound; slight club-root.
D.B. Best of All	40	19	Quite sound, and good quality.
D.B. Improved Purple-top ..	39	8	,, ,,
D.B. Prima Donna	39	3	,, ,,
D.B. Superlative	37	18	Going off; thinned a little wider than rest.
Studsgaard's Purple-top ..	30	17	Going off; smaller than rest and more side roots.

The soft turnips were Danish strains, some of which did fairly well, while others were only fair. They were carried on until the middle of June to test their keeping-qualities, and it was found that Dales Hybrid Amagergaard V and Fynsk Bortfelder were quite sound, that Ostersundom Amagergaard and Yellow Tankard Pajbjerg were going off, and that White Tankard Roskilde and Greystone Amagergaard were very fuzzy. The first two would appear to be good keepers, while the latter two were best for early feeding. The four varieties specially referred to have done fairly well and are worth another trial, although at present they do not appear to be better than our standard varieties.

The two mangold varieties, Barres Stryno VI and Danish Fodder sugar-beet, were fair croppers and of nice quality, but grew a little too far into the ground.

CLOVERS.

White.—The plot of imported wild white clover sown in 1923 made very good growth throughout the season, as also did the genuine Canterbury white sown in 1924. These areas were shut up for a seed crop, and it was very noticeable that, whereas the colonial clover was a mass of flowers, the wild white had very few flowers but an abundance of leaf. Owing to the scanty flowers on the wild white and the lateness of the season it was not worth while attempting to save the seed, so

sheep were turned on to graze the two areas. The sheep showed a slight preference for the wild white and grazed it barer than the colonial. On again shutting up the paddock the wild white was quicker to come

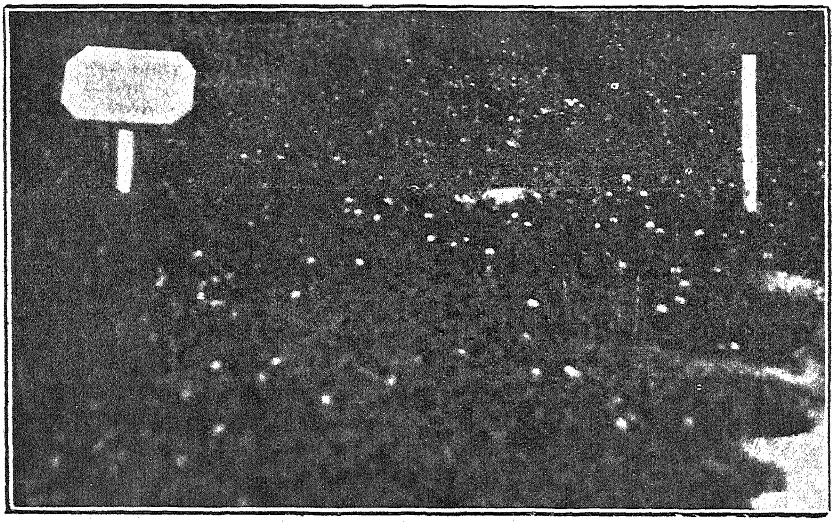


FIG. 1. PLOT OF IMPORTED WILD WHITE CLOVER AT MARTON EXPERIMENTAL AREA.
Note the very few flower-heads. Photo taken 8/3/26.

FIG. 2. COLONIAL WHITE CLOVER ON ADJACENT PLOT.
Showing abundance of flower-heads. Photographed 8/3/26.

away and produced practically no flower-heads, whereas the colonial was slower coming away and produced a fair number of flower-heads.

In order to extend these trials and, if possible, carry out some sheep-carrying tests three further areas, each $\frac{9}{10}$ acre, were sown in December with wild white (half the area sown with imported seed and half with seed saved from our own plot the previous year), genuine Canterbury white, and ordinary imported white. So far all have done about equally well, excepting for the fact that the seed of our own saving gave a germination of only 50 per cent., due to the large percentage of hard seeds. It is noticeable that, while the Canterbury and wild white varieties tend to spread over the ground, the ordinary imported white is tending to grow up off the ground.

Further areas were also sown in April with genuine imported wild white, Marton-grown wild white, wild white saved from a paddock of Mr. W. Wybourne, Whenuakura, wild white once grown from imported seed at Blenheim, and genuine Canterbury white. From all these plots it is hoped that in the future some useful data will be forthcoming as to the relative merits of the various strains and their worth to the farmer.

Red.—During April the following red clovers were sown to carry out trials similar to those with white clovers: Garton's Single-cut Late-flowering Red, Montgomeryshire-grown, Vale of Clywd (Welsh) Late-flowering Red, ordinary imported red, and genuine Canterbury red. Each plot is about an acre, and the clovers were sown with a mixture of perennial and Italian rye-grass. The two late-flowering varieties are coming into prominence in England, where it is claimed that they are more permanent than the ordinary red clover, and it will be interesting to see how they compare under our conditions with the varieties usually at the disposal of the farmer.

LUCERNE.

The lucerne area, which has just about served its period of usefulness, was top-dressed during the winter, and gave one fair and two small cuts during the year. Weights were taken on the various areas for two of the cuts, but the third, due to the dry autumn, was so light as to be not worth weighing. The scheme of top-dressing was: (1) A strip with super at 2 cwt. per acre and no lime; (2) a strip with no lime and no manure; (3) the rest of the field, lime $\frac{1}{2}$ ton and super 2 cwt. per acre. The green weights of the two weighings made were as follows:—

Table 4.

Treatment.	First Cut.	Second Cut.	Total.
	Tons cwt.	Tons cwt.	Tons cwt.
Lime, $\frac{1}{2}$ ton; super, 2 cwt.	9 13	2 11	12 4
No lime; super, 2 cwt.	9 12	2 8	12 0
No lime or manure	7 17	1 15	9 12

The no lime and no super weights are hardly a true criterion of the difference due to manure, as on this area more grass and weeds were cut and weighed than on the manured areas, where the more vigorous growth of lucerne kept the grass and weeds in check.

Weighings were also made on the areas devoted to drill-width trials, and the results for six seasons are given in Table 6. Here, again, the results are hardly a true indication of the actual weights of lucerne, as on the wider drills more grass and weeds were weighed than on the broadcast and 7 in. drills.

Table 5.

Year.	Number of Cuts.	Broadcast.	7 in. Drills.	14 in. Drills.	21 in. Drills
		Tons cwt.	Tons cwt.	Tons cwt.	Tons cwt.
1920–21 ..	3	17 0	17 5	17 0	14 14
1921–22 ..	4	25 10	19 14	22 12	21 8
1922–23 ..	3	18 15	17 13	18 4	16 12
1923–24 ..	3	15 15	14 17	14 4	13 6
1924–25 ..	3	18 7	15 14	17 18	15 4
1925–26 ..	3 (only 2 weighed)	12 16	12 1	12 6	11 7
Average per cut	..	6 0⅙	5 8	5 13½	5 5

PASTURES AND TOP-DRESSING.

The pastures did fairly well during the year, but the hay crops were not quite so good as in previous years, especially the second cut of clover off Field 4. Weighings were again made in Fields 1 and 4 on the top-dressing trial areas between ordinary ground Nauru phosphate and specially fine-ground Nauru. For the laying-off of these plots readers are referred to the Marton Area report for 1924–25, published in the *Journal* for August, 1925, page 118. The average weights of green material, obtained by twenty weighings on each ½-acre plot, have been recorded for the two years 1924–25 and 1925–26, and the main results may be summarized as follows:—

Field 1: Both forms of the phosphate have had a more marked effect in their second year than in their first. Over the two years the ordinary Nauru has given better results than the specially fine-ground. Field 4: Contrary to the results obtained in Field 1, ordinary Nauru has not given as good results in its second year as it did in its first. The specially fine-ground phosphate has given a slightly better yield in its second year, but for the two years has not given quite so good results as the ordinary Nauru. Superphosphate, applied to a separate plot four months later than the main Nauru plots and at the same time as a Nauru-and-sulphur plot, has given results a good deal better than any of the others. The Nauru-and-sulphur plot shows a slightly better return than the Nauru alone; in the first year of its application it was not so good, but in the second year it shows a large increase.

Field 1, which was sown in a temporary-pasture mixture in 1921, has carried, besides the hay crop for which it was shut up for three months and a half, on the average 2¾ sheep per acre for the year. Field 4, besides two hay crops for which it was shut up for five months, carried 1·6 sheep per acre. These two pastures have given quite fair grazing returns besides their hay crops, despite the facts that the grazing is not available at that period of the year when it would be greatest and the difficulty of getting sheep to adequately graze them at certain periods of the year.

The small permanent pasture near the old schoolhouse, which will in future be called Field 3A, was again obtained for a hay crop, and this was cut and weighed in December. The fertilizers used, their dates of application, and the green weights per acre are shown in the following table :—

Table 6.

Plot No.	Treatment (per Acre).	Date applied.	Hay-yield per Acre.		Total Weight per Acre, Two Years.
			1924–25.	1925–26.	
			Tons cwt.	Tons cwt.	Tons cwt.
1	Lime, 1 ton ; super, 2 cwt.	9/8/21 11/8/24	5 17	5 10	11 7
2	Bone-char, 4 cwt. .. Special Nauru, 4 cwt. ..	9/8/21 11/8/24	3 10	4 12	8 2
3	Walpole Island phosphate, 4 cwt. Ordinary Nauru, 2 cwt., special Nauru, 2 cwt.	9/8/21 11/8/24	4 10	4 8	8 18
4	Nauru, 4 cwt. .. " " ..	2/9/22 11/8/24	4 3	4 2	8 5
5	Control	..	2 1	1 2	3 3
6	Basic slag, 4 cwt. .. " " ..	14/7/21 11/8/24	4 7	2 4	6 11
7	Ordinary Nauru, 4 cwt. " "	14/7/21 11/8/24	3 19	1 16	5 15
8	Ephos, 4 cwt. .. " " ..	14/7/21 11/8/24	3 17	2 1	5 18

Although the different kinds of manure show a difference in weight, the greater difference was in the composition of the pasture constituents of the various plots. For instance, the basic-slag plot, although yielding just an average weight, was probably a better plot than some of the heavier yielders on account of its higher clover content. On the other hand, the yield from the control plot flatters it, as much of the material cut from it was of a very inferior nature, such as catsear, Yorkshire fog, and fiorin.

As forecasted in the final paragraph of last year's report, another piece of very old run-out permanent pasture of a little over 2 acres adjoining the Experimental Area was also secured for top-dressing trials. This will in future be known as Field 4A, and the objects of the experiments on both Fields 3A and 4A are to ascertain what improvement can be made on this type of poor pasture without breaking it up.

This area (4A) was laid off into twenty plots, every other one being left as a control, and the other ten were top-dressed during July as follows, the amounts given per acre being — Plot 2: Lime, 1 ton. Plot 4: Lime, ½ ton. Plot 6: Lime, ½ ton; super, 3 cwt. Plot 8: Super, 3 cwt. Plot 10: Basic super, 3 cwt. Plot 12: Basic slag, 3 cwt. Plot 14: Nauru, 3 cwt. Plot 16: Super, 1½ cwt.; blood-and bone, 1½ cwt. Plot 18: Super, 1½ cwt.; blood-and-bone, 1½ cwt.; sulphate of potash, 28 lb. Plot 20: Super, 3 cwt.; nitrate of soda (applied October), 1 cwt. A strip across all the plots was also top-dressed with kainit at 2 cwt. per acre.

This area was also cut for hay during December and weighings made from all the plots. The results of one year's treatment are hardly reliable enough for the actual results to be published. However, it was found that all the phosphatic manures showed a marked increase, and it was noticeable that the combination of lime and super gave better results than did either basic super, slag, or super alone. The best weight results were got from the combination of super and nitrate of soda, due in a large part to the excellent rejuvenation of the grasses of the rye-grass type on this plot. This was done, however, at the expense of the clovers, and this result will be gone into more fully before any definite statement is made as to the use of nitrate of soda as a top-dressing on this type of land, as the abnormal seasonal conditions may have had an undue influence.

As in the case of Field 3A, which has been top-dressed for a few years now, the improvement in the pasture is not so much in the increased weight obtained as in the proportion of the better types of grasses and clovers on the manured plots. On the control areas much of the material weighed was of an inferior nature, while on the manured plots there was a decided improvement in the quality of the hay.

The Lotus major sown in 1925 was such a poor strike that it was found necessary to plough up the ground, and the red-clover varieties referred to earlier were substituted. The brown-top sown at the same time has thickened out very nicely, and will be saved for a seed crop next year. Some small plots have also been sown with Danish strains of cocksfoot (two strains), brome-grass, meadow-fescue, Poa trivialis, Italian and perennial rye-grass, and yellow trefoil. If any of these show particular merit they will be saved for seed crops and larger areas sown.

CARRYING-CAPACITY OF AREA.

The sheep-carrying capacity of the whole Area for the year was 1¾ head per acre. Considering the amount of cropping done and the fact that it is not always possible to get suitable sheep at certain periods, this return may be considered quite satisfactory.

POSITION OF CONTAGIOUS MAMMITIS.

THE annual report of the Live-stock Division for 1925–26 states:—

"This disease has again been prevalent in dairying districts, although it would not appear to have been so troublesome as in the past. It is reported as having appeared to some extent in Otago and Southland, but mostly in the dairy herds of Southland. The Canterbury - West Coast district is comparatively free from the contagious form, but cases of the non-contagious form of mammitis have been noted. In all dairying districts in the North Island the disease is more or less prevalent, but, as stated, not to the same extent as in the past. Proprietary vaccines have been used fairly freely throughout the dairying districts as a prophylactic, and the results are being carefully watched, not with a desire to condemn, but in order that we might ascertain if they have any value as a prophylactic against this disease. The Department is unable, up to the present, to report in favour of this form of treatment. In some herds where inoculation had been practised the owners claimed an improvement as a result, but as in some cases adjoining owners had had similar experiences without the use of vaccine the claim is not substantiated. The present position, then, appears to be that generally immunity has not been conferred, and results are far from indicating any conclusive evidence of the efficacy of the particular vaccines in question."

TESTING OF PUREBRED DAIRY COWS.

APRIL–JULY CERTIFICATE-OF-RECORD LIST.

Dairy Division.

THE appended list gives particulars of performance of all cows which received certificates of record during the months of April, May, June, and July, 1926. This is, of course, a quiet period of the year in the operation of the C.O.R. system.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Holly Oak Queenie ..	L. A. McDonald, Levin ..	2 34	243·9	365	10,274·5	588·47
Alfalfa Heatherbell ..	Mrs. G. M. Harris, Wharepoa	2 80	248·5	365	6,853·9	421·07
Holly Oak Dainty Step	W. Oxenham, Uruti ..	1 353	240·5	365	6,274·3	416·49
Raithwaite Madge ..	Nicholas Bros., Mangatoki..	2 41	244·6	265	5,997·3	323·55
Golden Victress of Bull's	F. J. Watson, Bull's ..	1 351	240·5	313	6,113·2	312·73
Maple Farm Daffodil	J. H. Sherrard, Otaua ..	1 346	240·5	291	5,745·2	286·26
Duchess Double ..	A. J. Harris, Bombay ..	1 364	240·5	289	4,739·4	245·09
Senior Two-year-old.						
Palmdale Fancy ..	D. Kennedy, Morven ..	2 252	265·7	365	6,745·9	473·42
Sultan's Gem ..	A. J. Miller, Uruti ..	2 198	260·3	350	6,853·7	411·61
Lyndon Daisy ..	R. J. Johnston, Runciman..	2 328	273·3	264	6,423·4	362·24
Wichenford Anemone	F. I. Washbourn, Timaru ..	2 348	275·3	317	5,223·9	294·59
Distinction's Empress	Mrs. M. A. Wright, Pairere..	2 317	272·2	354	5,052·3	292·52
Three-year-old.						
Guiding Star ..	J. S. Rae, Taneatua ..	3 348	311·8	324	10,252·8	625·30
Mauriaena Lobelia ..	A. R. Clark, Hamilton ..	3 286	305·6	360	9,158·8	528·46
St. Aubin's Geranium	R. J. Johnston, Runciman..	3 178	294·8	365	9,225·5	503·50
Lyndon Juanita ..	R. J. Johnston, Runciman..	3 311	308·1	269	8,629·5	463·87
Cloverlea Laura ..	D. P. F. Malone, Kaponga..	3 362	313·2	250	7,827·9	421·98
Four-year-old.						
Woodlands Faith ..	H. C. Sampson, Hillsborough	4 56	319·1	365	10,439·5	688·11
Lynford Flower ..	D. O. Smith, Hastings ..	4 128	326·3	365	8,955·3	499·58
Rockview Heather ..	W. H. Fitness, Rehia ..	4 121	325·6	365	7,004·4	409·99
Mature.						
St. Aubin's Violet† ..	R. Wild, Drury	8 201	350·0	365	13,947·6	702·96
Oaklands Belle Mahone	F. W. Cornwall, Bell Block	5 349	350·0	266	8,722·7	583·34
Gleam's Eden ..	W. Robinson, Patumahoe ..	5 289	350·0	365	8,841·0	578·42
Neat Pilgrim ..	J. Robertson, Haumoana ..	5 198	350·0	323	8,072·2	419·63
	FRIESIANS.					
Junior Two-year-old.						
Maplewood Valdessa Pontiac†	John Court, Ltd., Auckland	2 28	243·3	365	18,001·5	666·19
Lichfield 21† ..	W. J. Polson, Fordell ..	2 29	243·4	284	8,104·4	347·79
Jewel Valdessa Pontiac†	John Court, Ltd., Auckland	2 35	244·0	317	8,414·6	300·69
Clothilde Segis Pietertje†	A. W. Chapman, Gordonton	1 364	240·5	295	6,980·8	246·63

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	FRIESIANS—*continued.*					
Senior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Rosevale Echo Sylvia Keyes*	North and Sons, Omimi ..	2 298	270·3	365	16,880·9	609·04
Grambling Fobes Johanna Grace†	John Court, Ltd., Auckland	2 209	261·4	365	15,243·6	556·74
Longbeach Netherland Queen 14th*	J. H. Grigg, Longbeach ..	2 313	271·8	365	13,872·1	482·35
Vrou Anna Van Racelands*	Smart and Sons, Tikorangi	2 327	273·2	359	14,692·2	477·29
Longbeach Transvaal Star II*	J. H. Grigg, Longbeach ..	2 280	268·5	365	11,722·0	405·46
Little Lassie Moonlight	C. Boyce, Tatuanui ..	2 272	267·7	365	11,355·0	375·14
Junior Three-year-old.						
Rosevale Kaatje Colantha Posch*	North and Sons, Omimi ..	3 94	286·4	365	14,623·7	506·59
Anawhata Colantha Johanna	B. F. Boucher, Kumeu ..	3 28	279·8	341	8,111·7	322·98
Senior Three-year-old.						
Friens Juliana ..	D. Dickie, Taita	3 232	300·2	278	10,348·0	378·31
Mature.						
Bloomfield Galatea Countess*	Bloomfield Farm Company, Wellington	5 214	350·0	365	18,965·2	709·45
Rosevale Katrina Posch*	North and Sons, Omimi ..	5 150	350·0	365	24,373·4	683·55
Longbeach Wallflower*	J. H. Grigg, Longbeach ..	7 42	350·0	365	18,511·1	658·74
Willowvale Galatea Segis*	Bloomfield Farm Company, Wellington	10 134	350·0	365	18,526·1	653·27
Eileen Girl† ..	A. W. Chapman, Gordonton	9 75	350·0	322	17,851·7	582·97
	MILKING SHORTHORNS.					
Three-year-old.						
Newstead Sally† ..	C. Roberts, Waitoa ..	3 27	279·7	300	8,978·2	361·77
	RED POLLS.					
Mature.						
Dominion Silken Lashes	Central Development Farm, Weraroa	5 347	350·0	320	7,896·1	401·09
	Second-class Certificates.					
	Jerseys.					
Junior Two-year-old.						
Mermaid's Lateefa ..	Mrs. G. M. Harris, Wharepoa	1 293	240·5	365	7,273·9	497·57
Senior Two-year-old.						
Kelvin Daisy ..	G. Buchanan, Paeroa ..	2 200	260·5	365	6,820·4	329·10
	Friesians.					
Junior Three-year-old.						
Rosevale Inka Lassie*	McDonald and Co., Dunedin	3 59	282·9	365	13,991·7	417·53

SEASONAL NOTES.

THE FARM.

CULTIVATION AND CROPS.

WITH September teams or tractors will be fully employed on a wide range of tillage-work connected with spring-sown crops. Land intended for the November and December rape crop should be deep-ploughed and allowed to lie fallow till ready for sowing. Land for potatoes and mangolds should be given a liberal dressing of any available well-rotted farmyard manure, and then deep-ploughed. Later it should be kept well stirred for sowing in October. Seed-beds for oats, peas, and oats and vetches for seed will be made on land already ploughed, and though sometimes the ground may need rather thorough working with cultivators, very often ordinary harrowing suffices.

Where spring sowing of permanent pasture is preferred the land should be well worked for seeding in October. The success of the strike with grass depends very much on the condition of the seed-bed. The last cultivations should not be deep, but rather in the nature of consolidating the soil, with just sufficient loose tilth on the surface to cover the seeds lightly. A number of failures occur through lack of consolidation, this being evidenced later by a good take in the wheel-marks of the machine and the foot-marks of the team, and poor germination over the remainder of the field. Many farmers, more especially in the South, sow grass with their spring oats. This practice, although not of the best, has something to commend it from an economy view-point. Care must be taken, however, to make a lighter sowing of the cereal with which the grass is sown. If convenient, the seeding with grass may be delayed until the nurse-crop of wheat, oats, or barley is sufficiently advanced to stand harrowing.

Suitable special crops for hay or ensilage are wheat or Algerian oats in conjunction with peas or tares. For spring use golden tares are usually preferred, but ordinary grey tares are quite suitable. In peas Early Minto and Grey Partridge may be recommended. For hay a sowing of 2 bushels of a cereal and 1 bushel of tares or peas per acre is a good mixture, but for ensilage a heavier and better crop will be got from 2 bushels of the cereal, 1 bushel of peas or tares, and ½ to 1 bushel of horse-beans. The beans help to hold the crop up. In localities where tares or peas do not grow very well it is advisable to increase the sowing of them to 1½ bushels per acre. A phosphatic manure should be used at 1 cwt. to 3 cwt. per acre, according to the condition of the land. All legumes like lime, and the addition of some should help them.

Where pea crops are grown for seed—Marlborough in particular—the wrinkle or field varieties should be sown within the first two weeks of September, preferably on land which has been limed during the winter and treated with superphosphate about a month before sowing-time. Ground previously infected with collar-rot should be avoided, as also seed from infested areas. It is all-essential that ground for

pea-growing should be well drained. Peas in soil containing stagnant water either fail to grow or rapidly succumb to collar-rot.

With the comparative decline of oat-growing, crop-rotation in Southland and south Otago is much less followed than formerly, and there is a tendency to grow several crops of turnips in succession on the same land. Owing to the prevalence of club-root this is not a desirable practice, and a forage crop of oats and vetches or oats and peas should alternate between any two crops of turnips.

SUBTERRANEAN CLOVER AND PASPALUM.

Early September is a suitable time for introducing subterranean clover into special paspalum hay paddocks where this is desired. At least ½ lb. of subterranean clover together with 1 lb. of white clover should be allowed per acre, mixed with manure, and the whole paddock top-dressed. This operation should follow after the field has been properly harrowed; and it is advisable to provide a chain or some other light harrow to assist in covering the seed, which is readily eaten by birds. The Cambridge roller is the ideal implement to use, however, as it presses the seed into the ground and a good strike is probable.

FERN-LAND MANAGEMENT.

Ploughing in September on broken fern land does much to injure the young rhizomes. Growth is commencing, and fern-shoots are then most vulnerable. Heavy tripod harrows should also be used during the coming month as soon as fronds appear in the grass-paddocks, for at this period grass is still backward and heavy stocking to crush young fern is hardly possible. The first crop of fronds is crushed and broken, the grass responds to the treatment from the harrows, and there will result a good growth of pasture, which can from then on be grazed heavily and the fern controlled practically by stocking alone.

LUCERNE.

Should soil conditions permit, the cleaning-up of lucerne stands can be carried out during the coming month. Growth which remained during winter should be very rapidly grazed off or cut, but, if grazed, care should be taken that the stand is not trodden and consolidated unduly, otherwise grass-growth will be encouraged. Immediately after removing the old growth, and provided the soil is dry enough, the stand should be given a few strokes with the cultivator to break up the surface and admit the air, which is so vital to the vigour and healthy growth of lucerne. A top-dressing may be given of 2 cwt. to 3 cwt. super, basic super, or slag per acre—preferably the super if the lime content of the soil is satisfactory.

Land intended for the sowing of lucerne later in the spring should now be prepared. A good sweet loam having an open subsoil is the best. Waterlogged soils are fatal; good drainage is essential. Soils deficient in lime require from 1 ton to 2 tons of carbonate of lime, to be applied during cultivation prior to seeding. Weeds must be killed by early ploughing and grubbing, the surface then being worked down to a fine firm seed-bed by harrowing every time a strike of weeds occurs. This consolidates the soil, but it may also be rolled before sowing to get a level surface.

—*Fields Division.*

THE ORCHARD.

CLEARING UP AFTER PRUNING.

AT this period of the year the majority of growers will have finished or nearly completed the pruning of their trees. Where not completed, growers should push on as fast as possible so as to finish this work before the trees break into growth. All prunings and remnants of crops should be gathered up and burnt and not left lying about, thus eliminating a source from which disease may spread to the trees. A clean-up of all rubbish should also be made in the orchard. Many fungi survive the winter on such rubbish. Sanitation is one of the greatest protections a grower has against disease.

CULTIVATION AND COVER-CROPS.

The spring ploughing should be commenced as soon as the soil is in a suitable condition, and where possible every endeavour should be made to complete the work before the trees come into bloom. Break down the soil before it dries out and becomes hard, so as to conserve the soil-moisture as much as possible and to permit the roots to enter the broken soil and to establish themselves there for the purpose of obtaining food-supplies from the aerated soil during the spring and early summer months. When the deeper cultivation is delayed well on into the spring many of these rootlets and root-hairs are broken and rendered useless at the time the trees are greatly in need of them to provide food and moisture with which to develop the various parts. No pains should be spared to avoid giving normal and weak trees a check in their growth from the time the buds begin to swell until the crop has been harvested.

Green crops, if not already ploughed in, should be turned in as soon as the ground is dry enough to permit of it being worked. In the lighter soils, in order to hasten the decomposition of the material turned in, the ploughed surface may be rolled flat.

MANURING.

In practically all orchards growers will find it to their advantage to apply a fertilizer to the soil, as bearing trees take a good deal of food from the soil annually. Our most successful orchardists fertilize their soil. From 5 cwt. to 12 cwt. per acre of a complete fertilizer should be applied according to the conditions prevailing in the orchard. The proportion of the ingredients of the fertilizer should be one part sulphate of ammonia, four parts 44/46 per cent. superphosphate, and one part 30 per cent. potash salts. Nitrate of soda may be used in place of sulphate of ammonia; it should not be combined with the superphosphate, but applied separately at a later date. In many situations blood-and-bone may be preferable, where a quick-acting fertilizer is not required, to either of the previously mentioned nitrogenous fertilizers. The wood-ashes saved from the burnt prunings and rubbish should be combined with the fertilizer and evenly broadcasted throughout the orchard. The material should be harrowed into the

ground right away. There are orchards where the application of ½ ton of lime per acre in addition to the fertilizer would give beneficial results.

PLANTING.

The planting of fruit-trees should be completed with as little delay as possible. It has been observed where trees have been planted very late and a dry spring has been experienced that they have not made the same good growth as earlier planted trees.

GRAFTING.

According to the locality and season, grafting may be safely done in most districts from the second week in September up to the middle of October. The work may be commenced as soon as the trees to be worked start into growth and the sap is rising freely in the stock. The scion should be kept dormant, as the best results are obtained from this practice. Bark grafting is the usual method adopted on trees which are being reworked. The scion to be used should be at least the thickness of a lead-pencil, and should contain three developed wood-buds. To prepare, cut the lower part of the scion to a thin wedge, while one of the three buds is preserved towards the base. Carefully pare the thin outer bark of one side of the wedge to ensure the cambium layer of the scion coming in close contact with that of the unlifted cut bark of the stock. Slit the bark of the stock to nearly the length the wedge of the scion is to enter. One side of the bark is lifted slightly, and the scion then pressed in against the unlifted cut surface of the bark. Bind firmly with raffia and carefully cover with grafting-wax to exclude air and rain. From two to four grafts should be inserted in each limb according to its size.

SPRAYING.

As we are now entering upon an important period in the control of orchard pests and diseases it is necessary that the trees should be kept growing as vigorously as is consistent with maturing good crops of high-grade fruit, and that the spraying programme should be carefully considered. Every effort should be made to control and reduce pests and diseases to a minimum, as it is in the best interests of every fruitgrower that the trees should be kept clean and healthy, and this can best be accomplished by (1) good materials properly prepared, (2) thorough application at correct times, and (3) early application of specifics which have been recommended.

Thoroughness in spraying is essential and important. Even though spraying is almost universal nowadays there are very few fruitgrowers who carry out this first essential in producing clean fruit in a thorough manner. Thorough spraying means that every leaf and fruit must be covered all over with a thin film of spray. To do thorough spraying the operator must move about and around the trees and spray the inside as well as the outside, and on the top as well as on the underside of the leaves, branches, and limbs. To obtain the best results and avoid loss sprays must be put on at the right time or times, because if applied at other times (1) they may have no beneficial effect, and (2) they may cause injury.

Early application in spraying is strongly recommended as a preventive measure for the control of pests and diseases. In this respect (1) poisons for chewing-insects and fungicides for fungi must be on the foliage and fruit before the pest or disease arrives if they are to do any good; (2) contact sprays for sucking-insects kill only when they come in contact with these insects, and sprays must be applied when they are present.

The pump should be thoroughly washed out after use and before another specific is put into it.

When to spray and what to spray with are the questions of vital importance asked by practically every fruitgrower. The following calendar will serve as a guide:—

Pest or Disease.	Spray to use.	Time of Application.	Remarks.
	Stone-fruits.		
San Jose scale. Red mite. Black and green aphis.	(1.) Red-oil emulsion, 1 in 15 (2.) Lime-sulphur, 1 in 15. (3.) Lime-sulphur, 1 in 50. (4.) Lime-sulphur, 1 in 120, or self-boiled lime-sulphur, 8–8–50.	(1.) Dormant period. (2.) Bud-movement. (3.) Early pink or pre-blossom. (4.) Petal-fall.	
Bladder-plum. Brown-rot. Leaf-curl. Leaf-rust. Die-back. Shot-hole.	(1.) Bordeaux mixture, 8–6–40, or lime-sulphur, 1 in 15. (2.) Lime-sulphur, 1 in 50. (3.) Lime-sulphur, 1 in 120, or self-boiled lime-sulphur, 8–8–50.	(1.) Bud-movement, towards mid-August. (2.) Early pink or pre-blossom. (3.) Petal-fall.	Prune out and burn all dead twigs and spurs at winter pruning. Gather and burn all mummies, together with portion of spurs to which they are attached. Apricot-trees should not be sprayed with lime-sulphur spray.
	Pip-fruits.		
Red mite. Pear - leaf blister mite. Woolly aphis. Scales.	(1.) Red oil, 1 in 12 to 15. (2.) Lime-sulphur, 1 in 10. (3.) Lime-sulphur, 1 in 35. (4.) Lime-sulphur, 1 in 100, or nicotine sulphate, 1 in 800, and soap.	(1.) Bud-movement, towards end August. (2.) Green-tip. (3.) Open cluster or pre-blossom. (4.) Petal-fall.	A number of commerical growers are using lime-sulphur, 1 in 12 to 15, at bud-movement, followed by oil, 1 in 20, when the primary buds are showing green-tip, with good results for control of red mite.
Apple-leaf hopper.	(1.) Lime-sulphur, 1 in 35. (2.) Nicotine sulphate, 1 in 800, and soap.	(1.) Open cluster. (2.) Petal-fall.	Each application should be made before winged stage of insect makes its appearance.

SPRAYING CALENDAR—*continued.*

Pest or Disease.	Spray to use.	Time of Application.	Remarks.
	Pip-fruits—continued.		
Black-spot of apple.	(1.) Bordeaux mixture, 6–4–50, or lime-sulphur, 1 in 10.	(1.) Green-tip.	
	(2.) Lime-sulphur, 1 in 35.	(2.) Open cluster.*	
	(3.) Lime-sulphur, 1 in 120, plus 8 lb. to 10 lb. precipitated sulphur.	(3.) Petal-fall.*	
	(4.) Lime-sulphur, 1 in 120, plus 8 lb. to 10 lb. precipitated sulphur.	(4.) Two weeks later.*	
Powdery mildew.	(1.) Lime-sulphur, 1 in 10.	(1.) Green-tip.	Prune off and burn infected portions of shoots, twigs, and spurs at pruning-time, and later as they appear.
	(2.) Lime-sulphur, 1 in 35.	(2.) Open cluster.*	
	(3.) Precipitated sulphur, 10 lb. to 12 lb. per 100 gallons.	(3.) Petal-fall.*	
	(4.) Precipitated sulphur, 10 lb. to 12 lb. per 100 gallons.	(4.) Two weeks later.*	
Black-spot of pear	(1.) Bordeaux mixture, 6–4–50.	(1.) Green-tip.	Prune off and burn all infected shoots and twigs. It is advisable after, on Winter Cole, P. Barry, and Josephine varieties, to apply lime-sulphur, 1 in 35, at open cluster, and subsequently lime sulphur, 1 in 100.
	(2.) Bordeaux mixture, 3–4–50.	(2.) Open cluster.*	
	(3.) Bordeaux mixture, 3–4–50.	(3.) Petal-fall.*	
	(4.) Bordeaux mixture, 3–4–50.	(4.) Two weeks later.*	

* Very important applications in programme of control measures for these diseases.

—*W. K. Dallas, Orchard Instructor, Dunedin.*

CITRUS-CULTURE.

Planting.—Where new plantations are being set out or replacements are required an effort should be made to complete the work by early September.

Varieties.—Dominant features of the best known varieties are as follows :—

Lisbon : The best known and most largely grown variety. Thorny trees of very strong growth ; reliable fruiter in successive crops ; fruit rather rough, with prominent nipple.

Eureka: The best summer-fruiting variety; widely grown. Trees thornless, robust growth, of good even habit; reliable cropper of well-shaped fruits—rather round, with even slope to nipple.

Messina: A variety largely imported into the Dominion. As grown in New Zealand identical with Lisbon in general habit—growth, foliage, thorns, and fruit.

Villa Franca: Tree almost thornless; generally light growth; a heavy summer cropper of well-shaped fruits.

Sicily: Rather robust growth; tree practically thornless; successive cropper of well-shaped fruits.

Mayer: Of recent introduction. Reported to be the hardiest variety grown; thorny trees; a precocious and heavy cropper of refined, well-shaped fruits; successive cropper. Juice decidedly better than usual lemon flavour.

Manures.—For young trees—say, up to five years—2 lb. blood-and-bone and $\frac{1}{4}$ lb. sulphate of potash may be applied with advantage now, and $\frac{1}{4}$ lb. nitrate of soda at two periods later in the growing season. For bearing trees 4 lb. blood-and-bone, 1 lb. superphosphate, and $\frac{1}{2}$ lb. sulphate of potash is a good dressing. These fertilizers should be evenly distributed over the whole area rather than immediately near the trees, and worked in by cultivation.

Cultivation.—During late August or early September spring cultivation should be done. This includes ploughing to turn in green crops which may have been grown for that purpose, or weeds, which are best disposed of at this period by being turned under. Though the soil may be in a clean condition, ploughing at this time of the year is beneficial, breaking up the compacted state of the soil and permitting aeration. In most citrus-groves there is an area near the trunks of the trees which cannot be ploughed or cultivated with horse implements. In order that this area may be dealt with by the hoe later, spade-work is necessary at the present time. If the land is not dug over now fibrous roots become so dense later as to make it impossible to more than scratch the surface without damaging the roots. On the other hand, digging the soil now, when fibrous roots are least necessary, a condition is secured which allows several inches of soil to be kept in good tilth during the summer. When cultivating to work in a heavy dressing of animal manures it is better that the manure should be spread along the furrows as ploughing is being done.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

BROODING-POINTS.

No hard-and-fast rules can be laid down in regard to handling brooder chicks. If success is to be achieved the individual concerned must study out things for himself. In the first place, he must see that the parent birds are fed and managed in such a way that the chicks possess outstanding health and vigour when placed in the brooder. Next in importance is that he shall be a close observer and anticipate the requirements of the chicks from day to day. There must be no such thing as "near enough" in the chain of management. Everything

must be done at a regular time and in a thorough manner. The great aim should be to make the chicks comfortable at all times, as only in this condition can perfect health be maintained.

It is especially necessary to take climatic changes into account, and to amend the methods of management accordingly. It should be remembered that if the slightest mistake is made, especially during the early stages, it cannot later be rectified, and trouble is almost sure to follow. For example, if the chicks become chilled, bowel trouble soon appears. Once this disorder sets in little or nothing can be done, and it will generally pay in the long-run to destroy the whole lot of chicks rather than try to doctor them. It is a common error to conclude that because the chicks look well on the day following a cold night, or where an incorrect degree of heat has been applied, they have not been affected. The chicks will have become affected, but will not show the result for two or three days. Where chicks show no inclination to leave the brooder it is usually a sure danger-signal that they have been chilled and that heavy mortality may be expected.

Nearly all troubles in connection with rearing brooder chicks are due to neglect of some essential detail. Failure to provide the correct degree of temperature and sufficient fresh air are among the most common. The desired heat should be maintained, but it must be a healthy heat, which, while providing the right degree of warmth, does not force the delicate chick to breath vitiated air. The mother hen and her brood provide a striking lesson in this respect. From her body-heat the chicks are provided with the desired temperature, while at the same time they are given an opportunity to breath the outside atmosphere. Most brooder troubles can be overcome by studying nature, but how few poultry-keepers there are who realize this!

While chill and its evil effects are the most common cause of mortality in the artificial rearing of chicks, it should not be inferred that a temperature falling below the desired degree is always the cause of the trouble. There are other ways in which chicks become chilled. Too high a temperature is just as fatal as too low a one. It not only lowers the vitality of the chicks, but in addition it makes them susceptible to chill when leaving the brooder and coming into contact with the ordinary temperature in the runs. Some brooders are constructed in such a way that the chicks cannot get away from the heat when it is excessive. This frequently happens on a hot night, and is undoubtedly the most common cause of chill. Brooders should be arranged in such a way that the chicks will be encouraged to settle down at night slightly away from the main source of heat when normal conditions prevail. Then in the event of a cold night following a hot one, or *vice versa*, the chicks are afforded an opportunity to move to and from the heat as instinct demands. When chicks are enjoying a comfortable degree of warmth they will spread over the floor of the brooder. On the other hand, when they are cold they will huddle together, and this brings on a sweated condition, which proves fatal to them in most cases.

Another common cause of chill lies in giving the chicks too much freedom for the first few days. They should be kept in the brooder for the first three days, having a division in it where fresh air and light may be obtained. Then they should be given a short run for the next day or two, increased by degrees in accordance with the prevailing

weather conditions. If baby chicks are given a lengthy run they are apt to lose their bearings, and thus feeling the change of temperature will huddle together and become chilled. The mother hen and her brood afford another valuable lesson in this respect. At first the hen allows the chicks only a very few minutes to feed and exercise, when she calls them under her body for the purpose of warming them. As they grow older, and providing the weather is favourable, the time given to exercise is extended, but never, even on the hottest days, does she neglect to give them a warm-up when required.

FEEDING OF CHICKS.

While proper temperature, ventilation, and strict attention to cleanliness are the chief factors in rearing brooder chicks, the matter of providing the right class of food must not be overlooked. There are numerous different mixtures that will give equal results. The main point is to feed sound, wholesome food. Dry, coarse oatmeal is ideal for the first few meals. This may be followed by a reliable brand of chick-raiser. Even these mixtures are apt to deteriorate through age or when kept in a damp place, and where they are used care should be taken that the material smells and tastes sweet before being fed. Chicks do not require food for twenty-four to thirty-six hours after they are hatched. Even then two meals are sufficient for the first feeding-day. During the early stages it is a good plan to slightly moisten the broken grain food. This will cause it to swell and become more easily assimilated than is the case with any hard grains.

Few poultry-keepers realize the value of dry, coarse bran for young chicks. Right from the start it should be in reach of the chicks to pick at. In feeding dry bran, especially to baby chicks, it is necessary to devise some means that will enable them to consume the food without wasting it. A simple method of doing this is to place the bran in a shallow box, say, about 3 in. high, 8 in. wide, and a length to suit requirements. Fill the box to, say, 1 in. from the top with bran, and place on top of the latter a piece of ½-in.-mesh wire netting. This should be cut to a size which will allow it to fit loosely inside the box, and thus fall by degrees as the chicks consume the food. In this way the food is within easy reach of them, and the wire netting prevents them from scratching it out and becoming soiled and consequently wasted. A strong point in feeding dry bran is that it does not become sour as when included in a wet mash. The latter should never be left in the run; as soon as the chicks cease to eat it freely it should be removed.

An important point in rearing brooder chicks is to keep them well exercised. The best way of inducing this is to feed some chick-food in the litter and make them scratch for it. Grit, charcoal, and clean water should be within easy reach right from the first.

Where boiled meat is not available it is a good plan to have a good grade of meat-meal in a separate receptacle for the chicks to pick at. Many poultry-keepers hold the opinion that the supplying of meat or its substitutes to chicks during the brooder stage tends to premature maturity, but this is not necessarily the case. Where the danger lies is by providing a too-liberal meat diet after the birds have passed the brooder stage. The object at this time should be to keep the birds steadily growing and bringing them to a desired size and age before commencing to lay. It is not generally known that the lack of animal

food is a common cause of chicks acquiring the habit of toe-picking and other cannibalistic habits. As a preventive against these troubles the chicks should be regularly provided with animal food. Better by far not to feed it at all than at odd periods. What the chicks never have they never miss, but if once they discover the taste of meat they crave for more, which is evidenced by the fact of their commencing to eat each other.

On no account neglect to give the chicks all the green food they will eat. There is nothing better than finely cut succulent grass, lucerne, or clover. Never feed these materials when they have reached a fibrous stage, as in this condition crop and gizzard compaction are apt to result. Lettuce, watercress, or almost any succulent green material is suitable for the purpose.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

BREEDING.

NORMALLY at this season of the year there are large patches of brood in the hives. A further examination may be carried out where the beekeeper was in doubt in the preceding month as to the hive being queenless or not. The absence of brood at this season will denote a poor queen or that the hive is queenless. In either case it is advisable to unite with another hive. This should be done immediately, as a queenless hive stands in great danger of being robbed by other bees in the apiary. A ready method of uniting is by placing the weak colony over a strong one on the stand of the latter, with a sheet of newspaper between the two hive-bodies. They may be examined after a couple of days to see if things are going well, and if the paper is not bitten through it should be torn in several places. In another day or two the united colonies will be working peaceably. In the case of the weaker colony it is wise to kill the queen before uniting.

At this examination the beekeeper must keep a strict watch for symptoms of disease. If foul-brood is discovered in a mild form the colony should be marked for treatment later in the season. Should the colony be badly affected, however, it is advisable to sulphur the bees and destroy the combs. Care should be taken to remove the hive to a place of safety until it can be properly cleansed.

OVERHAULING THE HIVES.

In August a great deal of the preliminary seasonal work of the apiary may be done. Each hive should receive a good coat of paint. This will help to preserve the timber, besides giving the hives a neat appearance. The bottom-boards should be scraped clean. During the winter months there is usually an accumulation of cappings, pollen, and dead bees, and, if left, this becomes a harbour for woodlice, which are very objectionable. A simple plan is to provide a spare bottom-board. Lift the hive on to the spare one, scrape the old board, and replace the hive. Remove all top boxes, and make the bees snug and warm for brood-rearing. Clean all weeds and long grass from round the hive. Long grass keeps the hives and bottom-boards damp, and acts as a harbour for insects.

CLEANSING HIVES AND FRAMES.

The beekeeper should not fail to cleanse all hives and frames that have been in contact with diseased colonies. This work may be undertaken now, and the hives and frames prepared for future use. Where there is only a small number of frames to be cleansed it is hardly worth while to attempt to save them. However, if much material has to be treated the saving effected will more than pay the beekeeper for his time and labour. There are several methods for treating hives and material, but perhaps the simplest and most effective is by the use of boiling water and caustic soda. Many beekeepers recommend the use of a painter's blow-lamp, but this is not always handy, besides which the charring of the hives is an advertisement for all time that they once contained diseased bees.

The most suitable vessel for cleaning frames is an ordinary washing-boiler. To every 8 gallons of water add 1 lb. of caustic soda, and allow to boil. The frames may be tied in bundles of six and immersed in the liquid. The caustic soda attacks the propolis and wax, and this immediately floats on top of the water. Three to five minutes' immersion will serve to cleanse each bundle of frames. Skim the refuse from the top of the water frequently, and as the solution weakens add more soda. Stack the frames in supers, and place in the sun to dry. The hive-bodies and bottom-boards may be cleansed by means of a swab. Immerse the swab in the boiling water and carefully wash the inside of the hives. Care must be taken when using caustic soda, as it is liable to burn the hands.

ARRANGEMENT OF HIVES.

There is no set system of arranging hives, and they may be placed according to the preference of the beekeeper. The entrances should all face the north if possible; but on no account should they face south or in a westerly direction if this can be avoided, as the cold driving winds fr m these quarters militate against successful brood-rearing. It is impor ant that the hives be so placed that the beekeeper need not pass in ront of the entrances when carrying on operations. Do not place the hives close together in long rows, as there is a danger of the queens entering the wrong hives and being destroyed; moreover, the plan will militate against successful manipulation, as the closely adjacent colonies will be disturbed whenever one is opened.

A good arrangement of the hives is to set them out in pairs, with at least 3 ft. between each pair. This affords the beekeeper plenty of operating room. The two hives comprising the pair may stand within a few inches of each other, leaving clearance for the roofs. The space between each two rows should be at least 6 ft., but more can be given if space is not a consideration. In order to preserve the bottom-boards the hives should be raised a few inches off the ground. Concrete blocks or old bricks make excellent supports for the hive. Each hive should have a slight cant, so that the entrance is about 1 in. lower than the back. This will prevent water from collecting on the bottom-board.

USE OF COMB-FOUNDATION.

Section 6 of the Apiaries Act provides that "In any case in which it is found by an Inspector that the bee-combs in any hive cannot

without cutting be separately and readily removed from the hives for examination, he may direct the beekeeper to transfer the bees to an approved hive within a specified time." This makes it very clear that the beekeeper must exercise some care to get the bees to draw down straight combs. It often happens that bees are put into hives fitted with frames which contain no foundation. Having done this the beekeeper is satisfied that he has complied with the Act, but such is not the case. It invariably happens that the bees cross-draw the combs, and the hive is in the same condition as if the bees had been put into a common box. The bees build the combs to suit themselves, and instead of drawing them straight down, as in well-built frames, they fill the hives from side to side with irregular pieces of comb and render the manipulation of the frames impossible without breaking them to pieces.

By the use of foundation beekeepers can obviate this trouble and induce the bees to draw down straight combs; thus examination for disease can proceed without hindrance. By the introduction of comb-foundation a great step was made in modern apiculture, and perhaps, next to the invention of the frame hive, it marked the most important development. The judicious use of comb-foundation gives the apiarist complete control over brood-rearing, and this factor is perhaps as important as that of good, straight combs. It usually happens that if bees are provided with only strips of foundation, or put into common boxes, they build a large quantity of drone comb, which will be subsequently utilized for breeding drones; thus one of the principal objects of the use of foundation is defeated. The presence of a few drones in the hive is imperative, as they are required for impregnating the young queens; but in practice it is usually found that the bees will contrive to breed a sufficient number for that purpose although full use be made of foundation.

Drones, as beekeepers know to their sorrow, are non-producers, and it is generally conceded that they do no work in the hive, but, on the other hand, consume large quantities of food gathered by the workers, and their presence in large numbers will militate against profitable beekeeping. Traps may be used for the purpose of catching the drones, but this method is not in general use, save perhaps by beekeepers who make a practice of rearing queens, and then they are applied for the purpose of trapping drones from undesirable queens. In practice it is by far the best policy to use full sheets of foundation; but in any case the beekeeper who neglects its use altogether will be up against the problem of having to transfer his bees at a later date.

ROBBING.

A strict watch should be kept for robbing. This is most likely to occur when feeding has to be undertaken, and once started it is about the hardest thing to cure. Feed only in the evening, so that the excitement created by the supply of warm syrup will have died down before morning. Keep the entrances to all hives contracted, and see that there are no cracks through which a robber could possibly enter. Perhaps the main cause of robbing, however, is the presence in the apiary of queenless or weak colonies. If the bees once discover a queenless hive there will be no peace until the source of trouble is removed. The inmates of such a hive will not defend their stores as will bees in a

normal condition, and unless the colony is united with another it will tend to demoralize the rest of the apiary, until none but strong colonies will be safe from the depredations of the robbers.

Where a weak colony is in danger of being attacked, and where the beekeeper is satisfied that it is worth saving—that is, if he considers the queen good enough to build up a strong colony by the time the main honey-flow sets in—his best plan is to pile wet grass on the alighting-board and well up above the entrance, keeping the grass wet for a day or two, and painting any cracks in the hive with kerosene or carbolic solution. This treatment will soon settle the robbers and restore peace in the bee-yard. However, the best thing to do with weak colonies is to unite them without delay with stronger hives. Like most other troubles, though, prevention is the best thing when dealing with robbers. Do not spill any syrup near the hive, do not leave any combs lying about, and do not have any weak colonies, and you will not be troubled with robbing.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

TOBACCO.

As a provision against contingencies it is customary to sow one or two extra beds of tobacco-seed, and this may be done now. There is a general tendency to make these beds rather small for the number of plants to be raised. This is a serious mistake, as the crowded plants are soft and drawn, and make a slow recovery when planted in the field, if they recover at all. Too often a number of blanks are the result, and when these are replanted the plant that is finally established is backward and is unsatisfactory, owing to being a stage or two behind the majority in growth and ripening. For satisfactory spacing of young plants in the seed-bed nine or ten square yards are required to produce sufficient plants for 1 acre in the field. The beds should be kept moist, but not wet, until the plants are about half-grown, when hardening will be assisted if watering is done more sparingly. About a month before lifting them they may be watered with liquid manure if considered desirable, dissolving 6 oz. nitrate of soda or 8 oz. sulphate of potash in 50 gallons of water. Such applications may be made fortnightly. To produce strong, well-developed plants for putting out in the field the beds must be kept weeded and the plants well thinned out.

The land in which the plants are to be set out should now receive careful preparation. Plough in all vegetation, and give it ample time to decay. Frequent cultivation should be given later to destroy seedling weeds, grubs, and cutworms, working in a dressing of lime where the land is inclined to be sour.

VEGETABLE-GROWING.

Weeds as well as crops will now be making rapid growth, and, as they are not compatible, advantage should be taken of all bright, dry weather to put the hoes through the crops to destroy the weeds before they reach any considerable size. This cultivation should be shallow,

as most of these plants are shallow-rooting and easily injured. Such seedling crops as require thinning should be given this attention as soon as the second pair of leaves appear.

Main crops of carrots, beet, potatoes, peas, celery, leeks, and salads may now be sown. Much work will be avoided if the sowing is done with discretion; sow thinly, and so save seed and avoid the tedious labour of thinning seedlings.

Where such permanent crops as asparagus and rhubarb are to be planted the land should now be clean, deeply worked, and in good heart. In such cases planting may proceed without further delay. Commercial plantings of asparagus are now set 18 in. apart, with 3 ft. between the rows. Land for this purpose that is heavy and inclined to form a surface crust is much improved by working in a good dressing of sand.

GLASSHOUSE WORK.

Tomatoes planted out under glass will now be established, and should be kept warm and watered with care. Water them only in the trenches in which they are set, and maintain rather a dry atmosphere.

Half-hardy plants for setting out next month, such as tomatoes, egg-plants, peppers, and Cape gooseberries, should be grown on steadily, with sufficient air to make sturdy plants. Where trouble is experienced through the plants "damping off"—*i.e.*, the base of the stem near the soil rotting off through the attack of a fungus parasite—the Cheshunt Compound may be used. The soil may be watered with it after sowing and covering the seeds. Young plants may be watered with it, or the boxes of soil, before pricking out, may be sterilized by watering the infected soil with the solution, after which planting may be proceeded with as soon as the soil is sufficiently dry.

This compound is composed of 2 oz. copper sulphate and 11 oz. ammonium carbonate reduced to a fine powder and thoroughly mixed. The mixture may be stored in a dry state in an airtight receptacle, without which it gradually loses ammonia and becomes less potent. The dry mixture should be stored for twenty-four hours in a tightly corked glass or stone jar before using. The solution is then prepared by dissolving 1 oz. in a little hot water and making up to 2 gallons with water. The solution must not be put in vessels of iron, tin, or zinc, as it would corrode them and lose its strength. Only just as much as is required for immediate use should be prepared. Plants already attacked will receive no benefit from the solution, but the causal organisms will be destroyed.

PLANTING OF EVERGREENS.

The present is a most suitable time for planting evergreens. Where black passions are to be grown they may be planted now in good, well-prepared ground with every prospect of success. The usual method is to plant them 12 ft. apart and train them to one stem to stakes about 5 ft. high, stopping the lateral growths as soon as a few leaves have formed. Fencing-posts erected at intervals of 24 ft., with a couple of No. 8 wires strained along the top, carry the vines after reaching the height of 5 ft. Make the rows 10 ft. apart, and let them run north and south. In suitable localities these vines should return payable crops for five or six years.

INSECT PESTS.

Many kinds of insects and their larvæ are in oversupply among the crops at this season of the year. The heavy losses incurred have drawn attention to this problem and resulted in some improvement in the methods of dealing with cutworms, slaters, slugs, &c. Bordeaux sprays or nitrate of soda are a certain protection for the plants, and where these can be used for a dual purpose there need be no anxiety. Powdered alum broadcasted weekly has been used during the past season by some growers of young plants with entirely satisfactory results—for the grower; it effectively protects the plants from slugs and snails. For larger areas some economy can be effected by mixing one part of powdered alum to two parts of slaked lime and broadcasting it at the rate of ½ cwt. per acre.

A cheap bait for all the insects mentioned, and recommended on the best authority, consists of 25 lb. bran and 1 [illegible]. arsenate-of-lead powder. Mix them well in a dry state. Add water, and mix thoroughly till the whole mass is damp, but not so wet that the flakes stick together. Let it stand for a few hours, then broadcast by hand about ½ cwt. per acre. For small areas mix one teaspoonful of arsenate-of-lead powder and two teaspoonfuls of cornflower, and cut up carrots into cubes to make 1 quart. Place the ingredients in a 2-quart jar and cover. Shake them together until they are thoroughly mixed, when they may be distributed among the plants to be protected. As these insects are night feeders, treatment is best given of an evening to young plants requiring the protection.

—*W. C. Hyde, Horticulturist.*

EGGS AND EGG-PULP IN COLD STORAGE.

THE following statistics have been issued by the Government Statistician :—

—		At 30th June, 1926.			At 31st March, 1926.		
		North Island.	South Island.	Dominion.	North Island.	South Island.	Dominion.
Eggs in shell	.. doz.	930	2,925	3,855	15,990	31,993	47,983
Egg-pulp	.. lb.	212,462	182,080	394,542	458,820	327,747	786,567
Frozen whites	.. lb.	246	476	722	432	910	1,342
Yolks ..	.. lb.	..	..	..	..	..	..

Interim Returns of Live-stock as at 31st January, 1926, issued by the Government Statistician include the following, the figures added in parentheses being the final numbers for 1925: Dairy cows, 1,279,860 (1,303,129); total cattle (including dairy cows), 3,412,612 (3,470,476); pigs, 463,522 (432,778); horses, 304,254 (309,123). The enumeration excludes boroughs. Interim returns of sheep were published last month.

The Kea.—The subsidy of 5s. per beak paid by the Department of Agriculture for the destruction of keas during the year ended 31st March, 1926, totalled £974 5s., equal to 3,897 birds.

WEATHER RECORDS: JULY, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

JULY, the midwinter month in New Zealand, was remarkable for three storms, particularly affecting the North Island. A cyclone developing in the North on the 10th had its greatest intensity on the following day northward of Kawhia and Poverty Bay, although, owing to its influence, rains were experienced and snow fell on high levels farther south. This storm ruled from the 10th to the 13th, and was followed almost immediately by a westerly depression which caused rains along the west coast and gales about Taranaki, Waikato, and other parts. Between the 23rd and 28th another westerly depression, with two centres, caused gales and heavy rains, particularly in the Manawatu, Wanganui, and Taranaki districts, and severe floods caused considerable damage in these parts.

The whole of the South Island, with the exception of Queenstown, experienced much less rain than usual. Many parts of the North Island also had rainfall considerably below their July average.

There were a number of frosts in the east-coast districts of both Islands, but the weather on the whole was dry and milder than usual.

RAINFALL FOR JULY, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	3·50	11	1·14	5·96
Russell	5·23	11	2·21	4·26
Whangarei	9·98	13	5·09	8·33
Auckland	2·81	17	1·16	4·98
Hamilton	3·40	18	1·04	5·24
Kawhia	4·26	17	0·90	6·86
New Plymouth	6·51	16	1·76	6·28
Riversdale, Inglewood	11·24	17	3·94	9·93
Whangamomona	8·45	7	3·40	7·68
Tairua	5·36	8	1·36	5·15
Tauranga	4·41	11	1·39	4·86
Maraehako Station, Opotiki	3·34	10	1·38	4·45
Gisborne	5·46	15	2·03	5·14
Taupo	3·63	11	1·57	4·21
Napier	2·28	12	0·69	3·90
Maraekakaho Station, Hastings	3·03	10	1·14	3·65
Taihape	3·47	15	0·96	3·15
Masterton	2·14	17	0·39	4·31
Patea	5·51	11	2·13	4·10
Wanganui	4·70	4	1·95	3·63
Foxton	6·68	10	..	3·26
Wellington	2·89	17	0·57	5·59
South Island.				
Westport	3·47	12	1·38	6·99
Greymouth	4·37	15	0·75	8·43
Hokitika	4·76	13	1·05	9·08
Ross	6·20	9	1·64	9·94
Arthur's Pass	10·55	11	2·93	12·53
Okuru, Westland	9·57	13	1·96	12·03
Collingwood	7·23	11	1·92	9·65
Nelson	1·09	8	0·60	3·49
Spring Creek, Blenheim	0·95	7	0·50	3·93
Tophouse	3·06	7	0·83	5·65

RAINFALL FOR JULY, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Hanmer Springs	3·56	15	0·78	4·65
Highfield, Waiau	2·38	6	0·92	3·63
Gore Bay	1·44	9	0·53	3·31
Christchurch	1·16	8	0·35	2·76
Timaru	1·14	8	0·58	1·93
Lambrook Station, Fairlie ..	1·14	5	0·64	2·72
Benmore Station, Clearburn ..	1·66	10	0·65	1·74
Oamaru	0·55	6	0·28	1·74
Queenstown	2·21	6	0·86	2·01
Clyde..	0·16	6	0·05	0·94
Dunedin	1·24	10	0·66	3·01
Wendon	0·65	5	0·19	1·98
Gore	0·96	13	0·35	1·96
Invercargill	2·24	15	0·40	3·28
Puysegur Point	6·18	18	0·94	6·18

—*D. C. Bates, Director.*

VARIETIES OF APPLES EXPORTED IN 1926 SEASON.

THE following particulars of the varieties of apples exported from New Zealand to Britain, South America, and Hawaii in the past season have been compiled from Orchard Instructors' reports, the figures representing the number of 1-bushel cases shipped :—

Sturmer, 179,968 ; Jonathan, 170,176 ; Delicious, 114,296 ; Dunn's, 69,659 ; Cox's Orange, 49,182 ; Statesman, 18,963 ; Dougherty, 18,333 ; Cleopatra, 15,782 ; London Pippin, 13,775 ; Worcester Pearmain, 7,769 ; Rome Beauty, 5,910 ; Gravenstein, 5,621 ; Lord Wolseley, 5,380 ; Rokewood, 4,818 ; Stayman Winesap, 3,903 ; Newtown Pippin, 3,806 ; Ballarat, 2,588 ; Scarlet Nonpareil, 2,438 ; Spitzenberg, 2,224 ; Salome, 2,133 ; Adams Pearmain, 1,931 ; King David, 1,898 ; Tasma, 1,824 ; Stark, 1,813 ; Willie Sharp, 1,552 ; Shorland Queen, 1,440 ; Edward Lippiatt, 1,288 ; Yates, 1,284 ; Premier, 1,103 ; Grannie Smith, 1,004 ; Brownlee's Russet, 867 ; Ribston Pippin, 835 ; Golden Pippin, 823 ; Parlin's Beauty, 726 ; Pioneer, 680 ; Alfriston, 649 ; Hoover, 637 ; Celo, 464 ; Boston Russet, 436 ; Swaar, 373 ; Horn, 337 ; Golden Russet, 315 ; Commerce, 312 ; Simmonds Winter, 300 ; Scarlet Pearmain, 294 ; Rona, 281 ; Shepherd's Perfection, 226 ; Blenheim Orange, 200 ; Crofton, 182 ; McIntosh Red, 168 ; McMahon's White, 138 ; Duke of Clarence, 119 ; Brighton, 94 ; Senator, 80 ; Baldwin, 48 ; Cambridge Pippin, 34 ; John Sharp, 30 ; Wagner, 23 ; Frimley Beauty, 20 ; Winterstein, 20 ; Sharp's Late Red, 14 ; Mobb's Royal, 8.

GRADINGS OF BUTTER AND CHEESE, SEASON 1925-26.

THE Dominion quantities of butter and cheese graded for export by the Dairy Division during the twelvemonth ended 31st July, 1926, were as follows :—

Butter : Salted, 59,739 tons ; unsalted, 2,818 tons : total, 62,557 tons—a decrease of 10·9 per cent. compared with the figures for the preceding twelvemonth.

Cheese : White, 47,174 tons ; coloured, 26,971 tons : total, 74,145 tons—an increase of 5·9 per cent.

In terms of butterfat, the 1925–26 amounts for butter and cheese combined represent a net decrease of 5·6 per cent. compared with those for the preceding year.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COWS SUFFERING FROM DEBILITY.

B. F. G., Taneatua :—

Last spring, after hard wintering, several of my cows became very poor and weak, not being able to rise after lying down, refusing to eat when fed, and dying shortly afterwards. On opening, I found attached to the walls of the "honey-comb" stomach a great number of worms—about ¾ in. long, thick, and the colour of earthworms. Lately I killed a fat heifer for beef and found the same kind of worm in her stomach. Are these worms injurious, and what is the cure?

The Live-stock Division :—

The worms found in the cows' stomachs were probably not the cause of much trouble among your animals. These parasites are very commonly seen in cattle and are not believed to cause much injury; therefore treatment for their expulsion is seldom resorted to. In the case of cows suffering from debility and poverty, however, it would be difficult to say that large numbers of such parasites had no injurious effect at all. The condition of your cows is evidently due to lack of nutritious food, and therefore we suggest that if you have no good hay or other forage crop available it is necessary to give your cows a daily ration of some supplementary food, such as a handful of bonemeal mixed with a good measure of bran or chaff. Good hay should be provided if at all possible. It will be more advantageous for you to spend time and money on providing good feed for your cows than on medicinal treatment. Thorough top-dressing of the pastures must not be overlooked, for it seems probable that your cows are suffering from a deficiency in their diet, which would be soon remedied by a course of the above-mentioned foods and liberal manuring of your land.

MIXING OF FERTILIZERS.

"Potash," South Norsewood :—

I intend using potash in addition to phosphate with my rape this year, and would be obliged if you would let me know if it can be safely mixed with either super or basic super and allowed to stand a week or so before use.

The Fields Division :—

Either of the phosphatic fertilizers mentioned may be mixed with sulphate of potash, although you will probably find that the mixture will not run quite as freely through the machine as straight super. On your class of soil we are of opinion that super would be preferable to basic super as a rape manure.

PLANTING OF WALNUT-TREES.

R. D. Williams, Otane :—

Would you kindly tell me the right time of year for planting walnut-trees; also how far apart and how deep the trees should be planted?

The Horticulture Division :—

In your locality walnut-trees may be planted up to the end of August. After that period there is a certain amount of risk of dry summer weather affecting them before they are sufficiently established. Plant the trees firmly to the same depth as they previously grew in the nursery. As the trees, when mature, have a spread of about 60 ft. diameter, they should be planted at that distance from each other if grown for the crop of nuts.

LAMBS AND KALE.

A. B., Bull's :—

Will you please inform me if lambs have ever been known to scald when feeding on Thousand-headed kale ?

The Live-stock Division :—

Although there is no direct evidence that lambs are affected by feeding on kale, we know that feed of a like nature, such as rape, does produce a systemic disturbance, so that it is possible similar results may follow too long feeding on kale. However, this is readily avoided by not leaving the lambs too long on kale alone, it being recognized that a change after a few days on this feed is essential.

LAMENESS AMONG COWS; YOUNG PIGS WITH SORE EYES.

J. P. C., Otakiri :—

(1.) Would phosphates, lime, and salt mixed make a suitable lick for dairy cows suffering from lameness ? Some seem swollen at joint just above foot, but I cannot see any open sore. Two are very lame in one hind leg. I suspect phosphate deficiency, though most of the land was top-dressed with super either last year or the year before.

(2.) I have some young pigs which develop sore eyes. The eyes discharge and eyelids stick. Some of the pigs swell across the forehead ; some die in about a week ; others recover and get all right again. Once they reach two or three weeks of age they seem immune. I feed them on whey alone. Is the diet responsible, and would molasses counteract the deficiency in whey ?

The Live-stock Division :—

(1.) It would be advisable to make quite certain that the lameness is not caused by injury to the foot, foul-in-the-foot being quite common among cows. A careful examination of the foot, especially high up between the claws, is very essential. Phosphate deficiency does sometimes produce lameness among cows when the feed is poor in quality, but it is probable that in such a case several of your cows would be exhibiting symptoms of starvation by their unthrifty appearance. If your cows are suffering from malnutrition we would advise you to supplement their feed by the addition of a ration containing a good proportion of phosphates. For this purpose a handful of steamed bonemeal fed daily in bran or chaff should soon effect an improvement. Phosphates, lime, and salt would make a good lick for cows, such lick being made up as follows : Coarse salt, 20 parts ; bonemeal, 20 parts ; slaked lime, 2 parts ; and sulphate of iron, 1 part. It is preferable, however, to give the cows a daily ration of feed rich in the necessary ingredients. Good hay should be available for all cows on short pastures at this time of the year.

(2.) With regard to the young pigs which develop sore eyes, we would suggest that there is evidence of a badly balanced ration. Whey alone is not a feed conducive to good health in pigs, especially in the case of a sow feeding a litter. Molasses are not sufficient ; the sow should be fed on skim-milk when possible, and should be given a daily allowance of pollard, maize, linseed-meal, or some equivalent, so that the young pigs may obtain a plentiful supply of good milk. The housing of young pigs should be clean and warm, a nice dry bed being essential to the rearing of strong and healthy pigs. All utensils used in the processes of feeding should be kept clean by frequent scalding, sour whey being totally unfit for sows or pigs of any description.

SOWS RUNNING WITH AN ABORTED COW.

J. BREMNER, Kokako :—

Is there any danger of sows contracting the disease if they are allowed to run in a paddock where a cow with contagious abortion has been isolated ?

The Live-stock Division :—

The cause of abortion among sows is obscure, but cases have not yet been attributed to the same specific organism as occurs in the cow. Therefore it appears that sows would not contract abortion through running in a paddock with a cow which has aborted.

The New Zealand

Journal of Agriculture.

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THE GRASSLANDS OF NEW ZEALAND.

SERIES II. NORTH ISLAND HILL COUNTRY.

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

GRASSES AND CLOVERS FOR HILL COUNTRY.

(3.) Poa Pratensis.

POA PRATENSIS is very widely distributed over the hill country in New Zealand, but the writer knows of no large areas where this grass has ever become a dominant. It occupies a peculiar position really, holding out under many extremes of conditions, and yet under no particular conditions applicable to hill country are there found high-yielding, pure Poa pratensis pastures. On certain lowland cropping-areas—such as loose, rich river-silts—Poa pratensis may become exceedingly prolific, and when these areas are uncultivated for a year or so quite high-yielding pastures of this grass may result. On such soils Poa pratensis is generally called "twitch" or "couch," and is ranked as a bad weed.

Poa pratensis is a demander of rather loose soil conditions and fairly high fertility. As far as its fertility requirement is concerned the writer ranks it along with cocksfoot (Fig. 76). In unconsolidated hill lands—volcanic, pumice, limestone, or rubbly greywacke soils—Poa pratensis, when sown, will almost invariably be found as a subdominant in the pasture, and the amount of feed it produces on such soils is proportional to the fertility of those soils and to the competition presented by other grasses and clovers with which it is associated.

These two factors really govern to what extent Poa pratensis will become dominant. The grass demands rather a high standard of soil-fertility in order to thrive at all well, but given this condition, in a mixed sward, cocksfoot, white clover, and perennial rye-grass particularly will easily beat Poa pratensis in production of herbage, and consequently it will be well subdued in such an association. Further, the more consolidated and the more fertile a soil becomes the lesser the place Poa pratensis occupies in that pasture. If the first of the botanical analyses recorded on page 303 of the May issue of the *Journal* is referred to one will see a very fair state of affairs concerning Poa pratensis in a consolidated, highly fertile soil. Here approximately 77 per cent. of the herbage of the pasture is perennial rye-grass, cocksfoot, and white clover, and Poa pratensis occupies only 2½ per cent.

of the pasture herbage. This pasture is on a rather loose volcanic soil type, which, when ploughed, sown down to crop, and then left a year in fallow, runs predominantly to Poa pratensis.

On soils less consolidated than that of the pasture referred to, and on poorer soils where cocksfoot is failing, and where there is a weak, rather open association, Poa pratensis in general is forming between 5 per cent. and 10 per cent. of the pasture sward, as shown in the analyses at the foot of page 303 and on page 305 of the same *Journal*. Poa pratensis in a weak association of this sort has ample scope to perform better if it were capable of doing so on such soils. The limiting factor to greater production from it on these soils seems to be a matter of soil-fertility, and, as before stated, as soon as the fertility is sufficiently

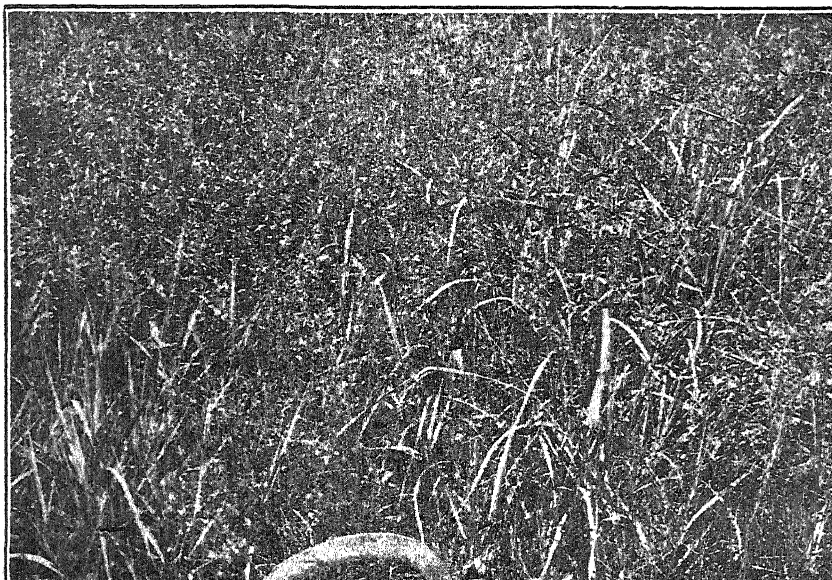


FIG. 76. POA PRATENSIS ASSOCIATED WITH COCKSFOOT.

This sward is on country that has been spelled for a time, and where the soil-fertility was not sufficient for rye-grass to thrive.

[*Photo by E. Bruce Levy.*

improved to grow vigorous Poa pratensis this grass is smothered out by cocksfoot, perennial rye-grass, and white clover.

From what has been said regarding the fertility requirement of Poa pratensis it is, as one would expect, on that hill country where cocksfoot is reasonably strong that Poa pratensis is seen to best advantage. Poa pratensis is quite a good shade-endurer, and consequently can persist for quite a long while on hill country even though the cocksfoot may periodically get away rank. Continual spelling of the cocksfoot, however, kills out Poa pratensis, though the latter is about the last of the associate species to go.

The conditions that will enable a certain amount of white clover to grow along with the Poa pratensis, cocksfoot, &c. (Fig. 77), are just

about ideal to keep the ground surface completely covered with pasture herbage of these species. When white clover goes out, and when cocksfoot begins to yellow and get stunted, Poa pratensis also diminishes greatly in yield. The underground stems tiller much more sparsely —perhaps only one weak shoot being sent up instead of some half dozen or so under more highly fertile conditions. This lessening of the number of the tillering shoots and general reduction in their size result in a weak pasture association that is open to weed or inferior grass invasion (Fig. 78).

With the exception of a few large areas—such as much of the Rangitikei County, the southern part of the Wanganui River area, and the limestone country of Hawke's Bay and the Wairarapa—it is only on isolated aspects of the general hill country that Poa pratensis has not dwindled to such an extent that the entry into the sward of brown-top, Danthonia pilosa, ratstail, &c., has been made possible. This, in the writer's opinion, is where Poa pratensis, like cocksfoot and rye-grass, has failed as a feed-producer on so much of the hill country.

On stabilized sandhills and on hill country near the sea (Fig. 79) where there is a looseness in the soil from blown sands, &c., Poa pratensis associates quite well as a subdominant in Danthonia pilosa-dominant pastures on these soil-types. The yield from the Poa pratensis, however, is small, excepting in the damper sand-hollows, sand-plains, and other slightly richer and damper spots, in which places Poa pratensis does make appreciable growth, beating, in fact, Danthonia pilosa on these particular aspects. When collecting for the field plots at the recent New Zealand and South Seas Exhibition, what were seemingly almost pure danthonia-dominant turfs were collected from the hill country at Henley, and when these were placed in position and watered well there was in four or five weeks' time in certain turfs almost a complete alteration in pasture dominance, the spindly Poa pratensis that was associated with the danthonia making such rapid growth as to easily outstride the danthonia.

On the limestone hills of Hawke's Bay, where the fertility is high and the soil-texture loose—for example, the hills round Waipukurau—Poa pratensis does exceedingly well, associating in about equal proportions with somewhat short-growing rye-grass, cocksfoot, white clover, and crested dogstail, and with danthonia on the somewhat drier ridges and sunnier aspects. On almost the whole of the Hawke's Bay coastal country, past Wairoa, and farther up the coast beyond Gisborne, Poa pratensis is strongly represented in the pasture turf—increasing in growth and dominance up to a point where the fertility is moderately high, and decreasing in dominance almost to extinction as the country runs more and more into danthonia dominant.

Throughout the Taranaki hill country, on the somewhat loose-textured volcanic soils with which most of the hills are covered, Poa pratensis is general, but, as already indicated, throws little feed and does not form anything like a close and continuous turf. An exception is on certain of the better rubbly, blue-papa country, where this grass does throw quite good feed and covers well. South of the Wanganui River, across to Mangaweka, Taihape, and Hunterville, Poa pratensis does exceptionally well, associating with cocksfoot, rye-grass, white clover, and crested dogstail.

FIG. 77. POA PRATENSIS ASSOCIATED WITH WHITE CLOVER AND COCKSFOOT.

Under these conditions Poa pratensis yields quite highly as an associate species. On steep country that is inclined to crumble away the binding effect of Poa pratensis is very valuable. (Compare with Fig. 80.)

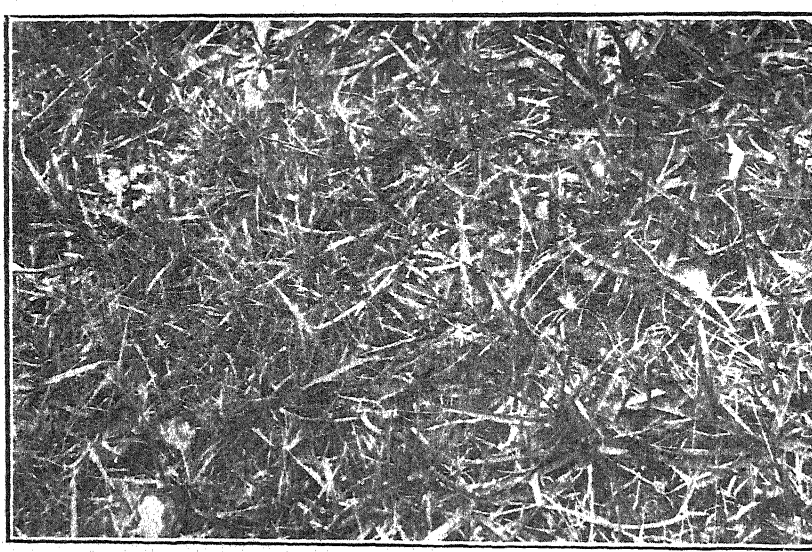


FIG. 78. POA PRATENSIS (ON RIGHT) WEAKENING AND OPENING UP AS A REDUCTION IN THE FERTILITY OF THE SOIL TAKES PLACE.

On the left brown-top is coming in and filling up the ground bared by the dwindling of the Poa pratensis.

[*Photos by E. Bruce Levy.*

Excepting on the hard stiff clays, it would be difficult to imagine Poa pratensis not existing in one form or another in any hill-country pasture-turf. As the writer has tried to indicate, its significance as a pasture species is almost entirely governed by two factors—the texture of the soil, and the amount of plant-food available in that soil. The fact that the fertility requirement of Poa pratensis is so high limits its value to a very great extent, for when conditions are suitable in this respect it is only on certain loose, rubbly natured soils that Poa pratensis is necessary in the turf, better grasses like rye-grass, cocksfoot, crested dogstail, and white clover being quite reliable on such soils to form the pasture sward. However, one must not lose sight of the value on the loose friable soils of Poa pratensis as a binding element that will keep the turf compact to stay any surface erosion so common on steep country (Fig. 77).

Poa pratensis is valuable in a purely mechanical way on hill country which is of a rubbly nature or of so loose a nature that tussock-forming species, such as cocksfoot, rye-grass, and crested dogstail, become so exposed by the soil breaking away from their crowns and washing down the slope as to make the persistence of these grasses most precarious (Fig. 80). By the binding effect of the Poa pratensis this surface soil erosion is largely overcome, and hence the maintenance of a sward containing tussock-forming grasses is much more certain than where these are sown without the binding, turf-forming Poa pratensis. The underground spreading growth-form is of vital importance on hill country, not only from its binding effect, but also from the fact that the spread over difficult places where establishment of seed is almost impossible is able to be accomplished by plants that have this underground root and crown system strongly developed.

Poa pratensis, in common with all underground creeping stemmed or short underground tillering crowned grasses, is liable when it has completely covered the ground surface and when no further ground is open for colonization by the plant to become what is commonly termed "sod-bound." As a matter of fact, the sod-bound state is the outcome of the exhaustion of all plant-food from that soil within reach of the grass-plant. While the plant was spreading out into new zones it was tapping fresh plant-food supplies, but these all having been tapped and the supply exhausted the plant dwindles in size because it is starved.

Under no conditions in New Zealand does there seem to be any difficulty in regard to the utilization of Poa pratensis, and in this the species can certainly be credited with a high palatability throughout the entire range of its growing-period. The writer is inclined to think, however, that the yield of Poa pratensis is never so high as to demand any special care on the part of the farmer to ensure its full utilization.

Summing up, one finds that Poa pratensis is essentially a grass of loose-textured soils, and requires for its satisfactory growth quite a high soil-fertility. On highly fertile soils, particularly where loose-textured conditions prevail and where surface erosion is bad, the presence of Poa pratensis among the rye-grass, cocksfoot, crested dogstail, and white clover serves admirably as a binding element to keep the sole firm and compact. Besides this mechanical service in

FIG. 79. TYPICAL COASTAL HILL COUNTRY IN HAWKE'S BAY (WAIROA).

Here Poa pratensis remains permanent in the sward and yields quite well, particularly so on the damper and slightly more fertile aspects.

[*Photo by E. Bruce Levy.*

the sward, Poa pratensis functions as a producer of a fair amount of highly palatable herbage. On soils that are poor and hard, running to brown-top, Danthonia pilosa, ratstail, &c., Poa pratensis is of comparatively little value, and no reliance can be placed upon it to ward off any one of these grasses from becoming dominant just so soon as the soil conditions have become hard or infertile. As a matter of fact, when cocksfoot begins to decline and white clover to fade out of the pasture Poa pratensis will likewise dwindle, persisting in the sward as a short-leaved, sparse-foliaged plant, tillering at distant intervals with one or two small tillers to each shoot, a weak, open, low-productive pasture being then presented (Fig. 81).

FIG. 80. TURF ON HILL COUNTRY CRUMBLING AWAY.

The crumbling-away of the ground surface seen here has placed the tussock-forming grasses—cocksfoot, rye-grass, crested dogstail, &c.—in a most precarious position. On such aspects Poa pratensis as a binding element in the sward would have largely prevented this erosion. (Compare with Fig. 77.)

[*Photo by E. Bruce Levy.*

POA PRATENSIS UNDER SHADY SECONDARY-GROWTH CONDITIONS.

Poa pratensis is one of the best shade-enduring grasses we have, and will persist for many years in moderately dense shade. Its crown being well below the ground surface enables the secondary growth to be fired with no injury to the grass itself. The removal of shade and letting in of light, together with the stimulating effect of the ash remaining, cause quite an appreciable and rapid production of new Poa pratensis growth (Fig. 82), and if only the soil conditions were such to enable a rapid permanent growth and cover from this grass it would prove invaluable from the point of view of control of the secondary growth. Unfortunately, the renewed growth seldom keeps going sufficiently strongly to produce much of a cover, and later so little feed is thrown that the number of stock enticed to work among the

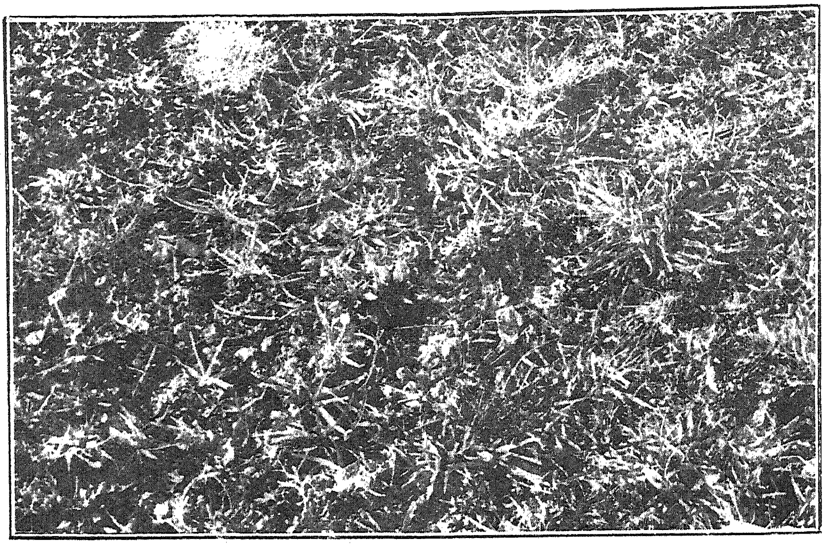


FIG. 81. COCKSFOOT AND POA PRATENSIS ASSOCIATION ON INFERTILE HILL COUNTRY.

The predominant grass showing is Poa pratensis, with a few cocksfoot-plants on the right. Note the isolated shoots of Poa pratensis showing little or no tendency to tiller. The contraction in size of the shoots and lack of tillering results in a very open association and low-production pastures.

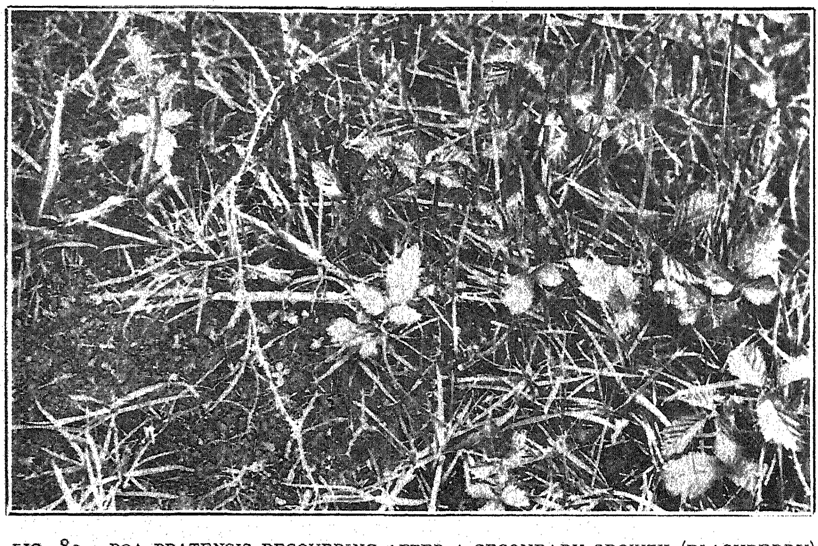


FIG. 82. POA PRATENSIS RECOVERING AFTER A SECONDARY-GROWTH (BLACKBERRY) BURN.

If there could be introduced into blackberry and other forms of secondary growth grasses that recover rapidly after fire and tiller out strongly to make a good tight sward the problem of secondary growth would be largely overcome. Poa pratensis promises well for a start, but under infertile soil conditions fails to keep going.

[*Photos by E. Bruce Levy.*

fern, &c., when this is reappearing is so small that the fern has more or less an unchecked return. Still, no doubt, even what amount of growth is formed is of some value, and it must be borne in mind that this growth is secured by no more expenditure than what it cost to clear the area by fire.

POA PRATENSIS IN PRIMARY AND SECONDARY BURNS.

On first-class hill country Poa pratensis certainly should be included in the primary forest burn as an associate species for the better grasses and clovers which are essentially of a tussocky nature. While these are persisting and growing well Poa pratensis also will thrive. The grass is rather a slow establisher from seed, and it is not until the main flush of the rye-grass growth wanes—generally in the second or third year—that much sign of Poa pratensis is to be observed. During this time, however, the plant will have formed underground creeping-stems, and as soon as the cover of the other grasses weakens somewhat it will spread fairly rapidly, particularly so in the looser situations. As has been said earlier, however, Poa pratensis is really of no more value than rye-grass or cocksfoot on the poorer and harder slopes of the burn. If it does establish and persist on such places it will throw practically no feed.

From the investigational work done already on the typical primary forest burn in Whangamomona County it would appear to be an open question whether the inclusion of Poa pratensis in the mixture is economically sound there. On that and similar country, wherever there is a good amount of kamahi, hinau, rewarewa, totara, or beech in the forest, it would seem essential to include brown-top in the mixture. Brown-top will do all that Poa pratensis can do, and it can be established much more cheaply and rapidly. One must bear in mind, however, that Poa pratensis does at least linger on most hill country, and may be expected to produce a certain amount of feed even on the worst of soils. Again, its persistence among secondary growth, and its return on the clearing-off of that growth, favour the inclusion of seed of this grass in the original mixture sown. An amount of 1 lb. to 2 lb. per acre is sufficient.

On the best-quality hill-country soils—blue papa, rubbly papa, and limestone formation—2 lb. of Poa pratensis should be included in the mixture. This practically is the only binding grass necessary to put on these soils, particularly so under good stock-management and top - dressing to keep the soil - fertility up to a high standard. Unfortunately, areas of this soil-type in standing forest remaining to be felled and grassed are comparatively small.

As far as the secondary burn is concerned—and particularly where there still persists within the secondary growth certain vestiges of Poa pratensis — the inclusion of more seed of this grass in the mixture is not recommended. In the writer's opinion one may accept this view in regard to secondary-growth country: that the high-fertility-demanding grasses must have failed on such country after being well established from the original seeding made on the primary burn, or else secondary growth would most assuredly not have got the upper hand. If these species failed after getting so good a start, how much less likely are they to succeed on the secondary burn, where conditions for

establishment and growth are infinitely harder. As far as the experimental sowings on secondary-growth burns in Whangamomona County are concerned, one can say fairly definitely that the money spent in Poa pratensis seed has been almost certainly a waste. In the last two seasons' sowings in that district Poa pratensis has not been included in the mixtures owing to the extremely poor showing it made in the previous sowings. Therefore, the inclusion of Poa pratensis in secondary-growth burns, unless on an exceptionally fertile piece of country, is not recommended.

PARALYSIS IN PIGS.

Paper read by C. V. DAYUS, M.R.C.V.S., Veterinarian, Department of Agriculture, Hamilton, at the annual meeting of the New Zealand Veterinary Association, Wellington, July, 1926.

No one will doubt the common occurrence of the condition of paralysis among pigs in certain localities in the Dominion, and the frequent inquiries concerning it. On looking through a recent number of the *New Zealand Journal of Agriculture* I noticed an inquiry from a farmer as follows: "My young pigs, about five weeks old, are developing what we call 'staggers' pretty badly. They are going in the hind quarters, but otherwise appear quite healthy. I would be pleased if you could advise me of a remedy for this complaint." How familiar every veterinarian must be with such an inquiry!

Paralysis in pigs is a common condition. That which concerns us most is the condition occurring in young pigs, but it may occur in all breeds of swine regardless of age or physical condition. It usually involves the hind legs, but in some instances the front ones are also affected. The disease is of considerable economic importance, because if preventive measures are not taken and pigs affected are not properly treated the trouble becomes chronic, complications arise, the animals will not develop properly, and it is not uncommon in such cases for a large percentage of deaths to occur.

CAUSES OF THE DISEASE.

I propose to deal first with some of the causes of the disease, both alleged and probable.

A contributory cause of some importance is inbreeding, which, if persisted in, will result in weakly, ill-developed, deformed pigs. Instances have been advanced where pigs from one particular boar have a tendency to be affected. The dangers of continued inbreeding can be eliminated by outcrossing and culling out of all breeding-animals in which a notable proportion of offspring continue to develop paralysis. Too few of our farmers take the necessary interest in the breeds and breeding of their pigs. It does not take one long to appreciate this fact when visiting a farm where a large number of pigs are kept.

Tuberculosis of the vertebral column may be a cause in some cases. Where the lesions are characteristic of tuberculosis the vertebræ—chiefly the dorsal vertebræ—become involved, a rarefying ostitis is set up, with consequent interference with the spinal cord.

Parasitic invasion may be accountable, and special mention must be made of the so-called kidney-worm, *Stephanurus dentatum (Sclerostomum pinguicola)*. This parasite is a nematode worm closely related to the sclerostomes. The male averages 1 in. in length, and the female 1½ in. It has sometimes been found in the kidney and liver substance, and less frequently in the spinal cord. It more commonly occurs in small cysts in the fat surrounding the abdominal viscera, especially in the perirenal fat. The kidney-worm has been described as being responsible for a variety of symptoms, such as stiffness and paralysis of the hind limbs. But, on the other hand, the parasite has been frequently met with in swine in large numbers without having produced any appreciable symptoms. When pigs have died from some disease, infestation with this parasite has probably been coincident. It is certainly difficult to understand what harm it can do, with the possible exception of an accidental case when it is found in the spinal cord. So far as is known, only one such parasite has ever been found in New Zealand, or has ever come under official notice here.

Another cause in some instances is the use of concrete for flooring in pigsties. It is now well known, I think, that no animal will thrive lying in contact with a concrete floor. I personally knew a noted Friesian breeder in England who built a new cowhouse to house one hundred cows, with a concrete floor. Six months later the whole flooring was broken up and relaid with bricks, owing to the cows becoming stiff with rheumatism and arthritis.

The kind of flooring for a pigsty has frequently been discussed, and it is admitted concrete is desirable, as it can be so easily drained and well cleaned. But it is essential that a wooden floor raised on trestles be put down where the pigs are lying, and plenty of clean, dry bedding on top of the wood. There must be an appreciable air-space between the wood and the concrete floor.

In individual cases there is always the possibility of injuries to the back, involving the spinal cord, being the cause of the paralysis trouble.

At the commencement of this paper I quoted a common inquiry from a farmer in the *Journal of Agriculture*, and the following is a portion of the reply, in the same *Journal*, by the Live-stock Division: "This 'staggery' and paralytic condition in pigs is frequently met with, and is believed to arise through errors in diet, coupled very often with bad housing-conditions. . . Continual feeding on sour milk or skim-milk alone is a common cause of digestive derangement. . . ."

There is no doubt in my mind that this answer is appreciably correct. But I personally believe that the condition in young pigs is very largely due to rickets, all factors indicated in the answer being contributory. This condition of rickets is a disease characterized by diminished calcification in the bones. Predisposing causes are bad housing, bad drainage, bad ventilation, lack of exercise and sunlight, and errors in breeding and feeding. The condition is more prevalent in some localities than others, and seems to prevail more extensively during some years than in others.

In recent years the cause of some deficiency diseases has been ascribed to the absence of accessory food factors known as vitamins. In the case of rickets the fat-soluble vitamin is absent. Recent investigations have shown that there is much more chance of swine suffering from a lack of the fat-soluble vitamin—especially swine kept

solely in sties—than there is in the case of horses, cattle, and sheep. This is principally due to lack of roughage and pasture-feeding.

It has been found that animals fed on foods from which all substances of a fatty nature had been removed could not live. The addition of fats such as palmitine, stearine, and olein—the most common plant and animal fats—gave good results. The addition of crude fats such as butter also gave good results. Commercial olive-oil or cotton-seed oil caused no improvement; therefore fat was not lacking, but some substance soluble in fats. This substance is called vitamin A or fat-soluble vitamin.

In New Zealand whole milk is rarely fed to pigs on account of its value. The one mainstay is skim-milk. The pigs get little roughage except when at pasture. The skim-milk from up-to-date modern centrifugal separators contains considerably less than 0·1 per cent. of fat, whereas cow's whole milk contains an average of about 3·9 per cent., and sow's milk is higher still, being about 4·8 per cent. It is absolutely necessary to endeavour to replace the amount of fat taken from skim-milk. I have in mind one place near Hamilton where a farmer has over five hundred pigs of all breeds, and they are getting products from a boiling-down works which contain a good amount of animal fat. Conditions of paralysis among the pigs are unknown on this place.

Mr. H. R. Denize, Inspector of Stock, Thames, has provided me with several instances in which the trouble has to a large extent been overcome on farms where at one time it was very prevalent. I quote one instance he gives: "The pasture was broken up and a crop of soft turnips put in, with superphosphate and basic slag, 3 cwt. to the acre, these fertilizers providing certain mineral elements. After the turnips were taken out the paddock was put down in grass again. The pigs then had plenty of roughage, and clean skim-milk not more than twelve hours old was also fed, with the addition of fat in the form of boiled animal offal." Mr. Denize also gives me an interesting example of a wild sow which was perfectly right and healthy when captured, but which later developed paralysis after being on the same diet of skim-milk and under the not very sanitary conditions as other domestic pigs already suffering from the disease.

SYMPTOMS.

I do not propose to dwell long in describing the symptoms of the disease; they are too well known to all of us. Generally the first symptoms noticed are disturbances in locomotion; the affected animal may be hopelessly stiff in movement, stagger and wobble, and finally fall to the ground. In other instances the pigs may be down and unable to rise; others are often sitting on their haunches and unable to rise up on the hind legs.

The disease is generally of a chronic nature, and continues for months unless death intervenes. It is frequently common in young pigs just after weaning, or even while still suckling. After the disease has continued for some time the muscles of the affected portions become tense and hard. At autopsy gastritis is frequently observed.

TREATMENT.

The question of treatment seems to me to be chiefly one involving general swine-husbandry, rather than a purely veterinary one, though

perhaps it is difficult to know where the one ends and the other begins.

Taking the causes, whether predisposing or actual, there are perhaps five main essentials in successful swine-husbandry: (1) Breeding; (2) housing; (3) drainage; (4) equipment; and (5) feeding. These points will be taken seriatim.

(1.) As I have already said, far more attention could be paid in this country to the breeding of swine, thus rendering the general constitution of the progeny more capable of withstanding disease. Continued inbreeding should be avoided, as this gives rise to weakly and deformed progeny. The selection of a breed is more particularly the choice of the individual breeder, and is more or less governed by the market demand, but the essentials to be desired are good feeding-qualities, early maturity, and prolific females.

(2.) Housing affords another opportunity for considerable improvement among farmers. The location can be determined only by consideration of the prevailing winds, drainage, and arrangements of other farm buildings. There should be freedom from dampness, and good ventilation without draughts. It is necessary for recently farrowed pigs to be kept dry and warm, and provision made for them to have plenty of exercise.

(3.) Proper drainage is equally important. There are many places where no consideration at all is given to this subject. It often happens that the lowest and most boggy and swampy site is selected. Possibly it cannot be used for anything else, so a piggery is made of it. Instead of this, the site should be selected high and dry in order to ensure good drainage. The wallow so frequently met with serves no useful or ornamental purpose, but provides a ready means for the propagation of infective agents. Better is it in every way and from every point of view to pasture pigs where possible.

(4.) Little attention is paid to the important matter of thoroughly cleansing all utensils and equipment used in the handling and feeding of swine. It is of paramount importance to keep everything associated with pig breeding and feeding in as sanitary a condition as possible. Farmers who fail with pigs can attribute their failure largely to a lack of this essential detail. All swill-tubs, milk-receptacles, feeding-troughs, milk-cans, milking-machines, and separators, &c., should be kept thoroughly clean, and scalded regularly with boiling water. The skim-milk pump and carrying-pipe so frequently found in use cannot be sufficiently condemned.

(5.) To further quote the reply given to the inquiry in the *Journal of Agriculture* by the Live-stock Division: "Continual feeding on sour milk or skim-milk alone is a common cause of digestive derangement. . . . The milk should be supplemented with boiled roots and pollard, or some equivalent meal or grain." By far the commonest foods for pigs in New Zealand are the dairy by-products—skim-milk, buttermilk, and whey. But there is no doubt that pigs fed on skim-milk alone, without pasture or equivalent grain or roughage, often fail to thrive, and animals thus affected become lame and crippled, and in severe cases become permanently stunted.

For maintenance certain elements of food are necessary. These elements must not only be of a certain quantity, but must be of a certain quality. Nitrogenous foods are used in repair and growth;

non-nitrogenous—which are largely carbohydrates and fats—are the source of energy, and the portion not consumed is stored as fat. The usual inorganic foods are water and salts, and are removed in secretions and excretions.

Mother's milk is unquestionably the diet of young animals. In the case of sow's milk there is apparently considerable variation in the quantity and quality. The following tabulation shows average analyses and ratio of sow's milk, cow's milk, and skim-milk :—

	Water. %	Albumen. %	Fat. %	Sugar. %	Ash. %	Ratio.
Sow ..	84·6	6·3	4.8	3·4	0·9	1 : 2·2
Cow ..	87·0	3·7	3·9	4·7	0·7	1 : 3·6
Skim-milk ..	90·0	3·6	0·05	4·9	0·6	1 : 5·6

Sow's milk naturally has much more fat than skim-milk. Young pigs sometimes break down after weaning, and sometimes while still on the mother. The milk of the mother depends upon her diet ; if that is deficient it is probable that her own milk is also deficient.

Skim-milk is one of the best and cheapest protein foods for swine ; buttermilk is of about equal value ; whey has been found to be worth about half as much. To make the ration balanced, however, it is necessary to increase the fat and fat-soluble vitamin content. Fortunately, the green portion of plants such as lucerne, &c., carrots, and sweet potatoes, also beef fat and cod-liver oil, have been found rich in this vitamin. In some parts of the country roots—turnips and mangolds—are grown as bulk food. Potatoes, pumpkins, artichokes, bran, pollard, and linseed-meal, &c., are all used to substitute the dairy by-product food, and are essential to make up the fat-deficiency. When pastured properly for some period of the year pigs should be found free from paralysis due to rickets. Pigs at pasture should be rung to prevent rooting.

Great controversy has frequently arisen as to when is the best stage for feeding skim-milk to pigs. It is the generally accepted rule that it should be fed fresh, but just twelve hours old, allowing enough time for gas to leave it. But a very important point, I think, is that pigs fed on sour milk should always be fed on it, and *vice versa*. Alternating of sour and fresh milk in feeding is likely to set up the greater digestive disturbance.

Probably the chief mineral deficiency is calcium, which can be supplied very cheaply by using finely ground limestone, chalk, or wood-ashes. Phosphates can be replaced by steamed bone-meal.

From the medicinal point of view it is usual to advise the farmer to give a dose of castor-oil with the food, and afterwards, daily, a teaspoonful of bicarbonate of soda to each pig, also in the food.

Great benefit would also be derived by the addition of cod-liver oil to skim-milk—say, two teaspoonfuls per pig—to pigs just weaned, in the morning and evening feed. Moreover, the oil could be used as a preventive in places where the disease has occurred. I understand that best Norwegian cod-liver oil could be supplied at less than 11s. per gallon, so the cost would be immaterial. The application of medicinal agents to pigs other than in food is not the easiest of tasks.

The main course in combating paralysis in pigs is the education of the farmer in correctives—such as hygiene and practical economic feeding—for what is a common but admittedly deficient diet.

RAGWORT (*Senecio Jacobaea*) AND ITS RELATION TO WINTON DISEASE.

ESMOND ATKINSON, Biological Laboratory, Wellington.

THE present article is intended to give a general account of ragwort as a weed, and to sum up what is known about it and its relation to hepatic cirrhosis, or "Winton disease." Much experimental work has been done in this direction in New Zealand and in other countries, and a number of reports have been published, but it has not hitherto been easy, except with the aid of numbers of reference-books, even to look through all the evidence collected. With the idea of making this evidence as convincing as possible, actual quotations have as a rule been made here from the more interesting of the reports on the various experiments, observations, &c., connected with the disease.

HISTORY OF RAGWORT IN NEW ZEALAND.

Ragwort is a native of the whole of Europe and the west of Asia, except the extreme north of these countries. It is particularly common in Britain, and is looked on as a native there also, but in all other parts of the world it is regarded as an introduced plant. G. M. Thomson ("The Naturalization of Animals and Plants in New Zealand") states that he cannot find any earlier record of it in this country than 1874, when he discovered it growing near Dunedin; but it rapidly increased in Southland, and in Auckland, Taranaki, and Wellington, and is now abundant in a great many parts of both Islands, though it is not evenly distributed throughout the Dominion. Ragwort was placed on the Third Schedule of the Noxious Weeds Act, 1908 (noxious weeds where so declared by local authority), but in the Noxious Weeds Amendment Act, 1910, it was transferred to the Second Schedule, which includes four plants to be considered as noxious under all circumstances—namely, blackberry, Canadian or Californian thistle (*Cnicus arvensis*), sweetbrier (*Rosa rubiginosa*), and ragwort or ragweed (*Senecio Jacobaea*).

DESCRIPTION OF THE PLANT.

Ragwort is a perennial herb springing from a thick rootstock with abundant shallow roots. There is no tendency in the rootstock to creep, and this means that one plant is not capable of forming a large patch like Californian thistle, for example. This fact is of importance in considering the different ways of getting rid of the weed from an infested area.

The stems are stiff, upright, and not much branched below, and reach a height of 4 ft. or so. They are strongly furrowed, but this is not always conspicuous, as they are very thickly clothed with leaves. The leaves are what is known as pinnatifid—that is, so deeply cut as almost to be compound, the segments in the case of ragwort being themselves crisped and deeply cut along the edges and strongly overlapping, while those at the tip of the leaf are united together to form one segment much bigger than any of the others. In colour the leaves are dark green above and rather paler below. Some spring from the roots and have quite long stalks; others spring from the stem, and

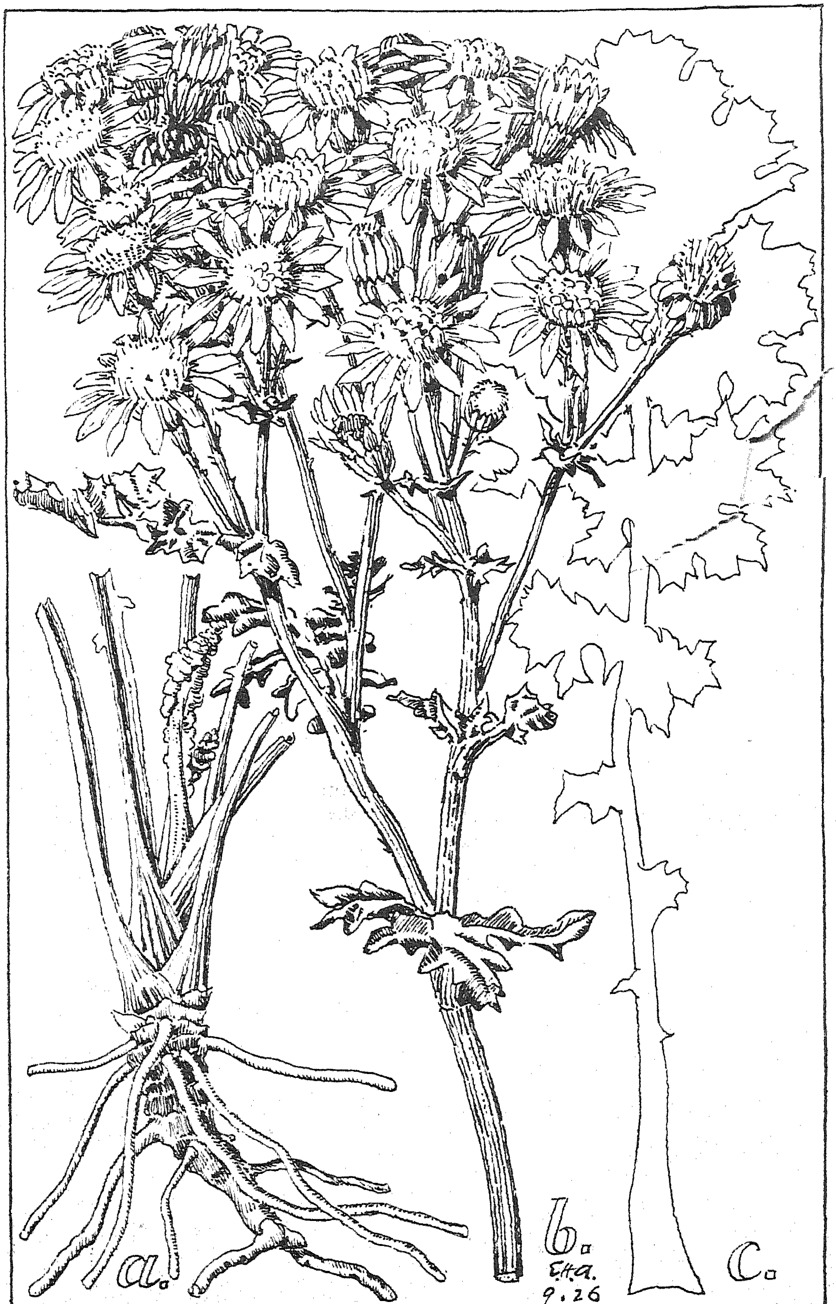


FIG. 1. RAGWORT (SENECIO JACOBAEA).

(*a*) Root and base of root leaves; (*b*) flowering-stalk; (*c*) outline of root leaf. All natural size.

[*Drawing by Esmond Atkinson.*

these upper ones have no stalks but clasp the stem closely. There is a wide range of variation in the outline, &c., of the root leaves on different plants. If two extremes are taken, it is very hard to believe that both can really belong to ragwort. Some plants are smooth and hairless, while others are more or less clothed with cottony hairs, particularly under the leaves and where they join the stems.

In the flowering season (which lasts normally from February to April, though it may be much longer) the stems branch very much above, the flower-heads being arranged in what are called corymbs —large clusters in which the flower-stalks spring from different heights on the stem—but are all cut off at the same level, and consequently form a flat-topped bunch (Fig. 1). The flower-heads are about ¾ in. in diameter, bright yellow in colour, and with from ten to fifteen conspicuous spreading rays. The involucre or cup underneath the flower-head is made up of narrow green bracts (scale-like leaves) with black tips. The achenes or " seeds " are of two kinds in each head— those from the ray florets being smooth, much curved, and angled in section, while those from the disc or centre are hairy, straight, and nearly round in section.

There is really no other weed of roadsides or of pastures with which ragwort could be confused. There are one or two native Senecios which are a little like it in some ways, but these are only to be found in situations that are quite different in character.

POSITION AS A WEED.

Ragwort is negligible as a weed of arable land, as it is not capable of surviving continuous cultivation ; neither is it to be feared in first-class grazing-country where a close permanent turf can be maintained. It has been pointed out that the root-system is not an aggressive one, although a plant cut off at the ground-level is capable of regrowth ; but, on the other hand, the seed-dispersal system is an extremely aggressive one. The inflorescence is very well developed (heavily infested ragwort country is a blaze of yellow in the summer), the " seeds " are small, and the pappus or down large in proportion. The weed is most dangerous in country where the soil is comparatively light, and where there is a tendency for the turf to break up in the summer, leaving open spaces ready to receive the seed as it falls. Top-dressing under such circumstances is worse than useless as a means of control.

From what has been said it will be seen that the chief means of spread of the plant has been through the agency of the wind from one area to more or less closely adjoining ones, though the seed sometimes occurs as an impurity in lines of agricultural seeds, a small amount being found, for instance, in southern Lotus major.

RELATION OF RAGWORT TO HEPATIC CIRRHOSIS IN CATTLE, HORSES, AND SHEEP.

In some old English herbals ragwort is called " staggerwort " or " stammerwort "—names which are at least suggestive of the plant's not being entirely innocuous when eaten. In his " Principles and Practice of Veterinary Medicine," Professor Williams described cases of what he called " stomach staggers " in horses, in which many of the

symptoms appear very much like those that have since been met with in Winton disease. He says that the disease "raged in the south-west of England and Wales in 1800 and 1819, the summers of which were hot and dry, prevailing most commonly amongst horses in low, wet pastures where the grass was rank. It was supposed to arise from their eating ragwort or staggerwort (*Senecio Jacobaea*), but of this there is no absolute proof."

In Canada a disease of cattle very similar to Winton disease in New Zealand had been known for many years previous to 1903, when experiments were carried out (inspired evidently by Gilruth's work in New Zealand) to discover its cause. The result of these experiments was that the trouble was considered to be definitely due to the eating of ragwort, and the disease, which was formerly classed as contagious, was removed from a list of affections dealt with under the Animals Contagious Diseases Act. Four experiments were carried out :—

(1.) To learn if this disease is contagious through the medium of infected stables. The evidence from this experiment was entirely against the idea of the disease being a contagious one.

(2.) To decide whether the disease is caused by the ingestion of ragwort (*Senecio Jacobaea*). Sixteen young animals housed in a new stable were tested with various amounts of the weed, and three of these died of typical "Pictou cattle-disease" (as it is called in Canada) in less than a year.

(3.) To ascertain if the feeding of ragwort (cured by itself) would produce the disease. Two healthy young animals were used. One was fed twice daily on chopped ragwort with very little bran, and died of the disease in eight months. The other, which was kept as a control, remained healthy.

(4.) A contact experiment, to ascertain whether the disease is contagious by direct contact with animals affected with the malady. After three months the animals experimented on were in good health and fine condition.

In South Africa a complaint exists known locally as "Molteno cattle-disease." Experiments were carried out (in this case also apparently as a result of the successful New Zealand ones) and showed a South African plant (*Senecio Burchelli*), allied to ragwort, to be the cause of the trouble.

A disease having the symptoms of hepatic cirrhosis has been reported from a number of States of America, and from Germany and Great Britain.

HEPATIC CIRRHOSIS IN NEW ZEALAND.

In 1903 Gilruth reported that for at least twenty years the disease had been known as the most deadly one attacking horses in Southland. A full account was given by him at this time of the symptoms in horses and cattle, a few of the more marked ones in the case of the former being a weak, staggering, swaying gait, yellowness of visible mucous membranes, dark urine, and sometimes frenzy followed by unconsciousness. In cattle one of the first symptoms is a diminution of the milk-supply and an acrid flavour of the milk, making it useless for butter ; others

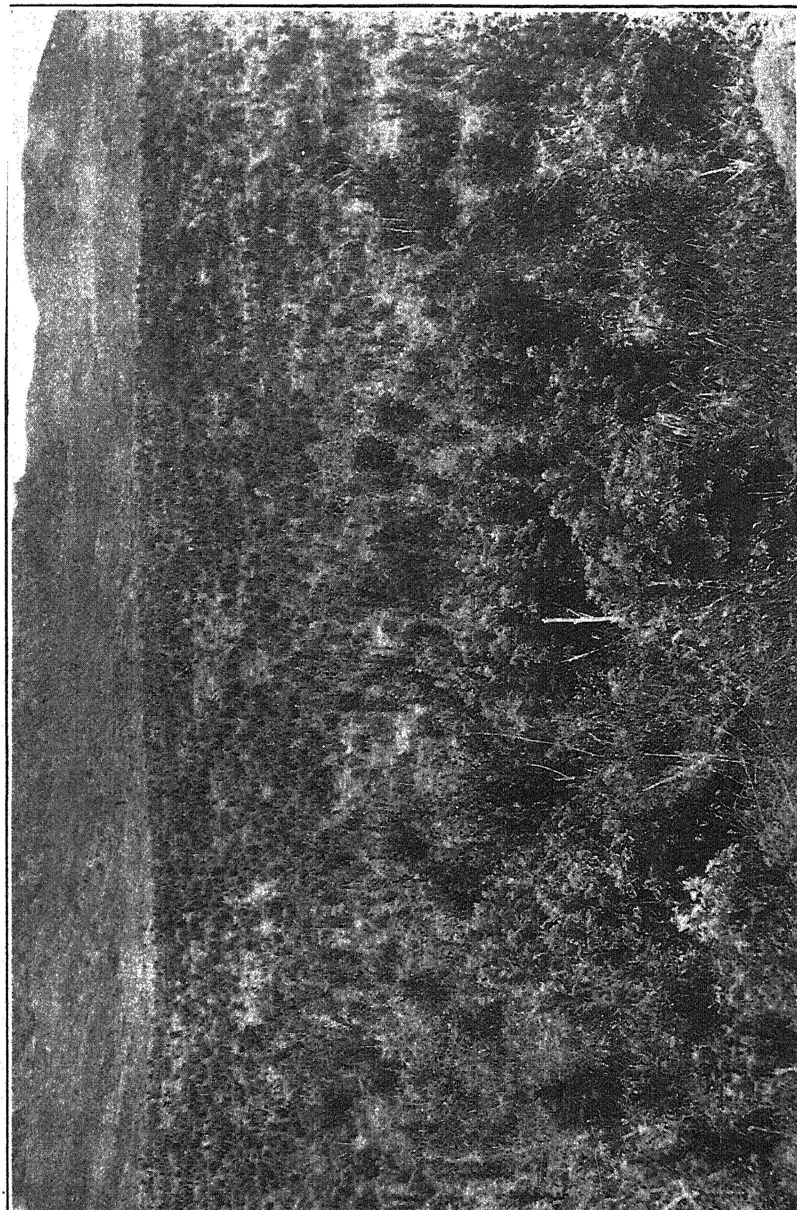


FIG. 2. GRASSLAND BADLY INFESTED WITH RAGWORT. [*Photo by E. Bruce Levy.*

are a peculiar odour of the skin, rapid emaciation, and chronic diarrhœa. Both horses and cattle show, port-mortem, yellow bile-stained tissues, and the liver almost always in a state of chronic cirrhosis.

Ragwort was long suspected as a cause of the disease, but the earlier experiments seemed not to confirm this, and attention was diverted from the plant for a time. Exhaustive experiments were made to test if a living organism was the cause. Gilruth says regarding them: "All the experiments were abortive so far as any pathological results were concerned, and it was consequently considered that, taken in conjunction with previous experiments, they effectively disposed of the possibility of the cause of these cases of hepatic cirrhosis being due to any bacteria or other organisms to be found in the liver or the alimentary tract."

On the occasion of the Auckland outbreak of 1901 attention was forcibly called to ragwort, which was particularly abundant that year on the block where the disease showed itself, and the presence of which was most marked in two other disease-infested places—Southland and Nova Scotia—almost the only thing common to three widely differing farming-areas. Suggested by this fact, a series of experiments was carried out:—

(1.) Two well-grown six-month calves were fed on a daily ration of 6 lb. ragwort, 2 lb. bran, 2 lb. chaffed oaten sheaves. Feeding began on 31st March, 1902, and continued till 17th April, when the calves grew dull and sleepy-looking, and were turned out on turnips and young oats. No. 1 died on 27th April; No. 2, on 29th. Cirrhotic liver was shown to be present in both cases.

(2.) Two cows and a horse were fed for three months on chaff made from naturally dead ragwort, one cow being given 1 lb., the second 2 lb., and the horse $\frac{3}{4}$ lb. per day—in all cases mixed with other fodder. After three months the cow fed on 2 lb. per day was killed and examined, and proved quite normal. The horse and the other cow were still so a year later.

(3.) To test the effect of green ragwort on stock a 5-acre paddock was fenced in on the Hanga Block, between Okoroire and Tauranga, and horses, cattle, and sheep put on it. The paddock was thickly infested with ragwort, which had previously been eaten off by sheep. First some cattle died, then a horse, the sheep escaping. The livers were forwarded for examination and all showed symptoms of cirrhosis.

(4.) An aged light gelding was fed on oaten chaff and on sun-dried ragwort made into chaff, besides a liberal supply of good hay. The feeding continued from 1st July to 22nd September, 93 lb. being given altogether. The horse died on 24th September with all the symptoms of the disease.

It was at about this time that the administration of strychnine was first found beneficial, though only temporarily so.

EFFECT OF RAGWORT ON SHEEP.

The statement was made by Gilruth that sheep could resist the action of the *Senecio* poison to an indefinitely greater extent than cattle or horses. During the period that the horse used in the foregoing experiment No. 4 was being fed at the laboratory two sheep received daily (as well as their food ration) $\frac{1}{2}$ lb. of the same supply

of ragwort as that given to the horse. At the end of six months the sheep were slaughtered, and a careful post-mortem examination was made. The liver and other internal organs were found in both cases to be perfectly healthy to the naked eye, and a subsequent microscopical examination failed to disclose any abnormality. Frequent opportunities offered themselves, and were made use of, of microscopically examining the livers of sheep depastured on ragwort country, but no marked pathological changes were seen.

A flock of 2,000 sheep was put twice on to ragwort, with an interval of three months between. The mob was taken off the second time on account of marked mortality, some showing while they were still on the weed, but the greatest after they had been removed from it. The most noticeable symptom was this yellow colour, the affected animals being referred to as "yellow sheep." The conclusions arrived at were that sheep can eat ragwort daily without harm (with very few exceptions) if it does not monopolize the soil, and if there is not too much they will check and even ultimately eradicate it. The reasons for the comparative immunity of sheep are supposed to be (1) that the plant is actually less toxic than in the case of horses and cattle, and (2) that owing to their small mouths the sheep can pick and choose to a very much greater extent when grazing.

GILRUTH'S CONCLUSIONS.

Gilruth concluded an exhaustive report on "Hepatic Cirrhosis affecting Horses and Cattle (so-called Winton Disease)," published in the Annual Report of the New Zealand Department of Agriculture for 1902-3, as follows :—

A careful consideration of the whole of the facts at our disposal, I submit, can only lead to one conclusion—viz., that *Senecio Jacobaea* is the cause of the disease (hepatic cirrhosis). In this, as in so many other matters, what now seems to have been the obvious was ignored; not without reason. That this common plant was known to exist, and had been known to exist without detriment, so far as was apparent or at least recognized, to stock; that sheep ate the weed with apparent fondness and evident impunity; that no one could ever say he had observed horses or cattle partake of the plant when growing naturally; that it was patent to the most casual observer these animals avoided its ingestion, even when it was almost impossible to do so; and that Mr. Park's experiment in Southland, so far as it went, resulted negatively (although slaughter and post-mortem were never made). All these facts tended to divert the mind from the true cause. In addition, when it is considered that the most experienced and highly trained pathologists in Canada had decided that ragwort was not the cause of the Pictou disease—identical with that known as Winton disease in New Zealand—it was but natural to look for causes more obscure, and withal offering more interest to the investigator.

Yet, when I had, as I believed, exhausted the possible means of demonstrating the cause to be a living organism, I was forced to again turn my attention to the herbage and to the common weed, which alone, as I have shown, was the one point of uniformity in three localities so widely divergent in every other respect as Nova Scotia and the two extremities of the colony of New Zealand. That *Senecio Jacobaea*—commonly known as "ragwort," "ragweed," "stinking Willie," &c. —contains an active principle capable of producing inflammation, more or less chronic according to the dose, in the liver of the horse and the ox is, I venture to submit, definitely proved by the experiments recorded. The fact that this weed was known in the days of Culpeper in certain parts by the terms "staggerwort" and "stammerwort" is extremely interesting.

Every endeavour should be made by the farmer, the local and the General Government of the Colony, to eradicate this weed, which is not only dangerous

to stock by ingestion, but cumbers the land, rendering it almost useless. Cattle and horses are naturally averse to partaking of the plant, but under certain circumstances, such as a paucity of every other fodder, or its presence in hay or chaff, they commence to eat the weed, and it seems most probable a liking is gradually acquired, the taste persisting evidently after the actual necessity for the ingestion of the plant has disappeared.

Palliative treatment has been demonstrated to be of value. Along with careful attention to dietary, strychnine given per mouth or subcutaneously, as I have shown, relieves the acute symptoms of the disease, and renders it possible for an animal's usefulness to continue for several years although affected with a cirrhotic liver. Such treatment is in no way curative as far as the real disease is concerned, and the only really satisfactory course to pursue is prevention by the eradication of the weed . . .

LATER OFFICIAL REPORTS.

The following extracts from later Annual Reports of the Department are added, since they give a clear idea of the present position in regard to ragwort and its relation to hepatic cirrhosis :—

District Superintendent, Dunedin, 1926.

Ragwort Poisoning : In many parts of the district the paddocks are a yellow mass when ragwort is in flower, and there is little doubt that this weed is spreading to a serious extent. A considerable number of cattle, more than we are aware of, also horses, die every year. When grass is plentiful stock do not touch it, but when the grass is scarce the cattle especially commence feeding on it, and evidently acquire a taste for it. On one farm at Edendale thirty-two cows out of a herd of sixty died from the effects of ragwort.

District Superintendent, Dunedin, 1925.

Dietetic Diseases : In the Southland district dietetic troubles are prevalent, principally due to osteomalacia, ragwort poisoning, and redwater. I am attaching Mr. W. D. Blair's report, and I quite agree with him that ragwort is responsible for a very large number of deaths amongst cows in Southland, and the same applies to cows in the Owaka district. It is quite evident that unless farmers take some effective measures to destroy this weed several districts will become practically useless for dairying. I recommend that a number of ewes be purchased and put on in the spring ; these by constant nibbling serve to keep the weed in check.

W. D. Blair, Veterinarian, Invercargill, 1925.

During the past year numerous cases were reported by the owners of cows in the dairying districts supposed to be tubercular, but on inspection these were found to be affected with ragwort, and in my opinion this weed causes a greater mortality amongst dairy cows than any other condition. On one property which I visited with the Commissioner of Crown Lands the owner informed us that of about forty cows with which he started dairying about three years ago he had practically lost the lot. One or two animals were noticeably affected on our visit. Inspection of the paddocks created no surprise, as it was seen that the ragwort was there to an extent that made it impossible for an animal to graze without partaking of the weed. A similar state of affairs exists in the paddocks throughout the dairying districts, and until measures are taken by the owners to rid the paddocks of the weed losses will continue. Few cases of the acute form of ragwort poisoning came under notice; practically all the cases assumed the chronic form, the animal gradually wasting away—in other words, becoming a "piner."

District Superintendent, Christchurch, 1925.

Some ragwort poisoning occurred in the West Coast area, and as the farmers there are inclined to look upon such cases as ordinary losses met with in bush areas and do not report them it is difficult to give an estimate of the approximate number lost. However, I am inclined to think that on one dairy farm six cows died during the year from the above cause. I am keeping in touch with this area, and spreading information in regard to prevention of the trouble.

MEANS OF CONTROL OF RAGWORT.

Compared with many weeds ragwort is quite easy to get rid of. It is of no importance on arable land because ordinary tillage methods destroy it completely. An important fact in connection with ragwort is that though the plant is a perennial and will survive a single cutting of the flowering-stems at the level of the ground, the repetition of this for a few years kills the whole plant without the need of grubbing it out by the root. Obviously a weed with such numerous and easily spread seeds must be prevented from producing them, and as it is quite possible for all the plants of ragwort in a paddock to be grubbed out and yet to retain sufficient vitality afterwards to infest the whole of the surrounding country the tops must be destroyed early in the season.

FIG. 3. RAGWORT-SEEDLINGS ESTABLISHED IN A WEAK, OPEN GRASSLAND TURF.
[*Photo by E. Bruce Levy.*

Although sheep are now known to be affected by the ingestion of ragwort in large quantities, the danger to them is slight compared with that to horses and cattle, and they are known to eat the plant—especially the young crown—quite readily, while horses and cattle are believed to acquire a taste for it only after they have accidentally consumed considerable quantities mixed with grass in country highly infested with ragwort.

In the various methods of dealing with ragwort that are quoted it will be seen that all its different peculiarities can be made use of against it, and, however abundant ragwort may be on his property, no one need despair of getting rid of it. The following quotations are mostly from the writings of authorities in the Department, and several of them are actual answers to correspondents who have inquired as to the best

means of dealing with the weed, as published in the *New Zealand Journal of Agriculture* :—

" If the area is not extensive, control by cutting before flowering ; repeat two or three times in certain seasons. On large areas sheep in sufficient numbers control it. Sheep should not be on ragwort for more than a month or six weeks, or bad effects will result." " When there are only small patches the plants can be destroyed by heavy spraying with one of the proprietary weed-destroyers. Where the weed is too plentiful for this method it can be kept under by stocking with sheep, provided the land is sufficiently improved to enable it to be stocked to its full carrying-capacity . . ." " When it is not possible to stock well with sheep, try frequent cutting of the young plant before flowering to prevent growth of leaves. If flowering is allowed and the weed then cut down, enough sap will remain in the stem to mature some seed. On small areas pull up or cut below the surface ; or cut down, gather, and burn. This must be done in the early flowering stages and not when the seed is mature . . ."

An inquiry by a Norsewood settler and the answers published in the *Journal* may be usefully quoted in full, as follows :—

" Will you kindly let me know," wrote the correspondent, " the best method of eradicating ragwort, which is very prevalent in this district. Most of the settlers pull the plants when in flower. In this case would broken roots left in the ground grow again next season ? I notice that when cut off level with the ground the plants spring up again."

The Live-stock Division (Noxious Weeds Inspection) replied : " Where ragwort is pulled it generally grows up again from roots left in the soil, as also happens when the plant is cut off level with the ground. The plant, being a perennial, will grow from the same root for three years. It is thus propagated both by seed and roots. Where it is possible to keep the land well stocked with sheep during the early spring months, when the plant-growth is young and tender, no trouble will be experienced in keeping it in check and eventually in eradicating it. Where the land cannot be altogether given over to sheep, excellent results have been obtained in many parts of the Dominion by grazing a number of old ewes along with the cows on the pastures during the late winter and spring months, these ewes eating the soft crown out of the plant when it first appears. The ewes can then be sold off fat in the summer. When neither of these methods can be adopted, frequent cutting or pulling up immediately before the plants flower will be found effective. The plants will have to be so dealt with for three years, however, before the weed is eradicated from the land. Ragwort is a very free seeder, and if it is allowed to flower and seed the ground will become polluted, and will take at least three years to become thoroughly clean again. In the foregoing it has been assumed that the land in question cannot be cultivated. Cultivation soon suppresses the weed, in spite of its perennial character and free production of seed."

Mention is made in the Annual Report of the Department of Agriculture for 1906–7 that one of its Inspectors in the South Auckland District had noticed that " black caterpillars " destroyed a large number of ragwort-plants. The writer is indebted to Mr. D. Miller,

Entomologist to the Department, for the following note on this insect (and insects generally) as a means of controlling weeds: "It is often suggested that some insect might be made use of as a means of controlling ragwort in New Zealand. The larvæ of the common black and white "magpie moth" (*Nyctemera annulata*)—well known under the name of "woolly bear"—which originally lived on the leaves of several common New Zealand Senecios, is now often seen on ragwort and allied plants such as groundsel (*S. vulgaris*) and German ivy (*S. mikanioides*) as well as on garden cinerarias. The caterpillar is very often extremely abundant on ragwort, which in some parts of the country is quite eaten down by it. In some years the larvæ are much more abundant than in others, this being due to the influence of controlling factors, among which are insect parasites. As a means of controlling ragwort *N. annulata* is not satisfactory. Too much dependence should not be placed upon insects as a control for weeds, and there is a great danger of widespread damage being done to plants of value by the introduction of any allegedly weed-controlling insects."

While the subject of ragwort-eradiction is being dealt with, H. C. Long, "Common Weeds of Farm and Garden" (England), may be quoted. He emphasizes strongly the value of systematic mowing of the plant as a means of destroying it, and states that this method is much used in Canada. He takes the following from McAlpine and Wright ("Transactions, Highland Agricultural Society, 1894"): "The best method is, when cutting off the heads, to leave a sufficient length of the lower part of the stem untouched. In the autumn, when the ground has been softened by rain and the roots have shrunk and hardened, they may be quite easily pulled out by hand."

There is necessarily a certain amount of repetition in the foregoing control methods as given by different authorities, and there are also a few points which appear contradictory, but which have been included without hesitation as it must be obvious that there can be no rule-of-thumb method given for getting rid of a weed which is at home under so many different circumstances.

SHEEP INFESTED WITH LICE.

THIS matter is dealt with by the Director of the Live-stock Division (Mr. J. Lyons) in his annual report for 1925–26 as follows:—

"Sheep affected with lice are still too numerous, and far too many prosecutions for exposing lice-infected sheep at saleyards have had to be taken. It is the general opinion of the Inspectors in the various districts where this trouble is found that it is attributable not so much to a deficient dipping solution as to carelessness in both mixing and dipping. Inquiries from careful sheep-men confirm this, and indicate that where the directions of manufacturers of well-known dips on the market are followed no trouble is experienced. It is legally a punishable offence to expose sheep affected with lice for sale in a public saleyard, and, as the presence of lice can be just as readily ascertained by the owner as by the Inspector who examines them at the yards, it is an unpardonable act of neglect on the owner's part not to take proper precautions to ensure that his sheep are free from lice before taking them to a sale. The Inspector has the power to order the withdrawal of the sheep from sale, and it is a question whether we should not adopt this practice generally, with a view to seeing if any better results will ensue, in place of our present practice of allowing the sheep to be sold subject to immediate dipping, followed by a prosecution."

CONTROL OF BROWN-ROT IN STONE-FRUITS.

RECENT EXPERIMENTS AT HENDERSON.

Horticulture Division.

SINCE brown-rot decay of stone-fruit first became epidemic in New Zealand, early in the present century, methods for the control of this fungous disease have received considerable attention by the Department of Agriculture.

In 1916 the disease was the cause of considerable loss to Auckland growers, and in this *Journal* for March of that year the late Mr. A. B. Mansfield gave an outline of the life-history of the fungus and suggestions for its control, including orchard and packing-shed hygiene, and winter sprays of bluestone solution or bordeaux followed by summer sprays of lime-sulphur. In the *Journal* for August, 1917, the late Mr. G. Esam detailed the experience of Hawke's Bay growers in the control of this disease. His recommendations were along previous lines, but with further valuable additions. Orchardists in that district giving special attention to stone-fruit and applying the treatment in a thorough manner were successful in obtaining a practical control while others were experiencing heavy losses.

Since that period extensive tests (also recorded in the *Journal*) have been carried out at the Arataki Horticultural Station, and in co-operation with fruitgrowers in the Auckland and Nelson districts, with varying results. Sometimes the results have been very satisfactory; but one important conclusion arrived at, and which seems correct, is that harvest periods with warm humid atmospheric conditions are specially favourable to the disease, which is then naturally more difficult to control. As this condition often occurs in the Auckland District, further researches in the problem have been carried out there.

LAST SEASON'S EXPERIMENTS AT HENDERSON.

During the 1925–26 fruitgrowing season experiments were carried out in the orchard of Dr. R. H. Makgill, at Henderson. Dr. Makgill kindly co-operated with Mr. W. H. Rice, Orchard Instructor, Auckland, who reports as follows:—

During the winter of 1925 all peach-trees on the area were methodically pruned, special attention being given to the removal of dead or diseased wood and the removal of mummified fruits. All prunings and refuse were carefully collected and removed from the area and destroyed. The land was ploughed at bud-movement, and no further cultivation given until after the fruit had set, as past local experience had shown the bud and blossom form of brown-rot to be extensive, and it was hoped by non-cultivation to reduce the dissemination of spores.

For early sprayings the orchard was divided into two blocks, in order to give bordeaux *versus* lime-sulphur a comparison base for later sprays. These base or initial sprays were applied at bud-movement, according to variety, from 17th to 27th August, bordeaux, 5–4–50, followed by red-oil emulsion, 1–15, being applied the same day as an insecticide on one block, and lime-sulphur, 1–15, on the other block.

No oil was applied to the lime-sulphur block, lime-sulphur being considered a dual-purpose spray. The base sprays were applied under good conditions, and several days elapsed before rain fell. The blocks were divided into sections for further sprays as follows (the numbers in the table representing trees) :—

Peach Varieties.	Block 1.			Block 2.			Total Trees.
	Initial Spray, Lime-sulphur, 1–15.			Initial Spray, Bordeaux, 5-4-50, followed by Oil Emulsion, 1–15.			
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.	Section 6.	
Paragon ..	30	35	19	33	42	42	201
Carmen ..	14	11	6	7	18	20	76
J. H. Hale ..	6	4	1	1	0	0	12
Golden Queen..	4	7	4	7	9	11	42
Hay's Cling ..	4	3	3	2	3	1	16

The following table shows the later sprays applied to each section :—

Stage of Growth.	Section 1.	Section 2.	Sections 3 and 4.	Section 5.	Section 6.
Early pink ..	Lime-sulphur, 1–50	Atomic sulphur, 10 lb. in 100 gallons	Lime-sulphur, 1 gallon, plus atomic sulphur, 10 lb. per 100 gallons	Atomic sulphur, 10 lb. in 100 gallons	Lime-sulphur, 1–50.
Petal-fall ..	Lime-sulphur, 1–120	Ditto ..	Lime-sulphur, ½ gallon, plus atomic sulphur, 5 lb. per 100 gallons	Ditto ..	Lime-sulphur, 1–120.
Three weeks later	Ditto ..	Atomic sulphur, 8 lb. in 100 gallons	Lime-sulphur, ½ gallon, plus atomic sulphur, 4 lb. per 100 gallons	Atomic sulphur, 8 lb. in 100 gallons	Ditto.
Half-grown..	,, ..	Ditto ..	Ditto	Ditto ..	,,
Prior to ripening	,, ..	,, ..	,, ...	,, ..	,,

This gave as a test lime-sulphur *v.* atomic sulphur *v.* combination lime-sulphur plus atomic sulphur, each following on the respective base or initial sprays of bordeaux and lime-sulphur.

No valuable variation of results in brown-rot control were obtained from the winter base sprays, though bordeaux was a decided advantage in the control of peach leaf-curl, and gave much better general health tone to foliage than lime-sulphur. The latter allowed leaf-curl to develop, and the foliage showed less development, with a characteristic crinkle of the edges. Spring forms of brown-rot infection noticed were bud-rot, blossom-rot, and twig-rot. These forms were remarkably consistent according to the susceptibility of the variety ; the degree of infection was practically equal under each spray test, *and appears to be largely a matter of varietal resistance.* The following notes were made :—

Carmen : Bud-rot, blossom-rot, and twig-rot all bad. Loss equals 70 per cent. of crop as indicated by bud-development.

Golden Queen : Bud-rot and blossom-rot bad ; twig-rot very bad. Loss of 50 per cent. of crop as indicated by bud-development. Tree of

most luxuriant habit, and so maintains a heavy supply of new wood in spite of excessive twig-rot.

J. H. Hale: Considerable bud-rot; very early infection resulted in buds falling badly. Loss of 40 per cent. of crop as indicated by bud-development. Traces only of blossom-rot and twig-rot.

Hay's Cling: Pronounced bud-rot, equal to 40 per cent. loss of crop as indicated by bud-development. Traces only of blossom-rot and twig-rot.

Paragon: Practically no bud-rot or blossom-rot; traces of twig-rot, but not sufficient to affect crop.

Though none of the sprays applied gave thorough control of spring infections of brown-rot, a far lesser infection was present than on similar varieties in orchards in the same district where consistent spring spraying was not done nor the land properly cleared of dead wood and mummified fruits.

Summer Infection (Fruit-rot or Ripe-rot).

The comparative degree of fruit-infection on the various sections and varieties is shown in the next table:—

Section.	Spray.	Variety of Peach-tree.				
		Carmen.	Paragon.	J. H. Hale.	Hay's Cling.	Golden Queen.
		Lime-sulphur Base.				
		Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1	Lime-sulphur ..	50	35	20	50	30
2	Atomic sulphur ..	5	5	No crop	15	2
3	Atomic sulphur plus lime-sulphur	35	5	,,	10	5
		Bordeaux Base.				
4	Atomic sulphur plus lime-sulphur	15	5	2	6	5
5	Atomic sulphur ..	5	5	2	2	2
6	Lime-sulphur ..	35	12	10	15	5

The poor results on Section 1 (lime-sulphur on lime-sulphur) as compared with Section 6 (lime-sulphur on bordeaux) may be accounted for in large measure by Section 1 being so located under a belt of pines as to be overshadowed from the afternoon sun, while Section 6 was in an open situation and may be considered a good test of the summer value of lime-sulphur. Atomic sulphur will be noted as showing satisfactory results, though not a full control. Atomic plus lime sulphur gave reasonably good results, and, being less expensive than atomic alone, showed equal results per unit of cash expenditure. Lime-sulphur did not compare favourably with either atomic or the combined spray.

In the main the season was not one in which brown-rot was as prevalent as usual, but the benefits of summer sprays were well emphasized. On 22nd January, 1926, a heavy gale with driving rain was experienced in the district, resulting in a large proportion of all crops becoming chafed and twig-bruised, which provided a ready means of infection by brown-rot.

Unsprayed trees in an adjoining block and adjacent parts of the district had from 50 to 95 per cent. of the crop affected by brown-rot, whereas the fruits under sprays of atomic sulphur showed only 2 per cent., atomic plus lime sulphur 5 per cent., and lime-sulphur 5 per cent. to 30 per cent., of infection respectively.

Autumnal Condition of Trees under Test.

Atomic-sulphur sections: Strong growth; bright-green, luxuriant foliage, hung well into early winter; general condition all that could be desired.

Atomic-sulphur-plus-lime-sulphur sections: Good condition, though not so robust or luxuriantly foliaged as atomic sections.

Lime-sulphur sections: Good condition, but hardened growth. Foliage somewhat sparse, constricted, and generally less luxuriant than one would desire.

Summary.

Bordeaux is to be preferred to lime-sulphur as a delayed dormant spray.

Bud-rot, blossom-rot, and twig-rot are modified but not fully controlled by any of the sprays applied. Degree of infection is largely a matter of susceptibility of variety.

Atomic sulphur, 8 lb. to 100 gallons of water, gave reasonably satisfactory control of summer fruit-rot.

Atomic sulphur, 4 lb., plus lime-sulphur, ½ gallon per 100 gallons, while not so good as atomic sulphur, 8 lb. to 100 gallons, alone, shows promise of reasonable control at a lesser cost.

Lime-sulphur is not satisfactory for summer control, and lowers the health tone of the trees.

Atomic sulphur exercises a beneficial influence on the general health of the trees.

Shelter-belts should not be allowed to overshadow the orchard area.

Readers who are specially interested in this subject may be referred to the valuable research work of Mr. G. H. Cunningham, of the Department's Biological Laboratory. The life-history and habits of the brown-rot fungus were fully described by him in this *Journal* for August, 1922. The article—entitled " Brown-rot, *Sclerotinia cinerea*, Schroeter: Its Appearance, Cause, and Control "—is available in reprint form as Bulletin No. 101. Mr. Cunningham has also dealt very fully with brown-rot in his book " The Fungous Diseases of Fruit-trees in New Zealand."

Contagious Mammitis.—During the official year 1925–26 the number of samples of milk received at the Wallaceville Veterinary Laboratory for examination for contagious mammitis was 2,097, being an increase of 484 over the previous year. Of this number, 1,178, or 56·2 per cent., were found to contain the specific organism. The increase in samples is considered by the Live-stock Division to have been due to the greater amount of publicity centred on this disease during the earlier part of the year, and as a result of lectures and general advice by veterinary officers.

CORTICIUM-DISEASE OF POTATOES.

FURTHER EXPERIMENTS AND ADVICE FOR CONTROL.

G. H. CUNNINGHAM, Mycologist, and J. C. NEILL, Feild Mycologist, Biological Laboratory, Wellington.

IN the *Journal* for January and February, 1925, were published details of laboratory experiments on the control of corticium-disease of potatoes, and as a result it was recommended that a solution of acidulated mercuric chloride be used for treating the seed tubers. Subsequently a series of field experiments based on this laboratory work was undertaken at Gore Experimental Area, Southland; Moa Seed Farm, Central Otago; Ashburton Experimental Farm, Canterbury; and Central Development Farm, Weraroa, Wellington.

In these field experiments were used the solutions recommended in the *Journal*: (*a*) Overnight treatment, 1–10–10,000 (= 1 gram mercuric chloride, 10 c.c. concentrated hydrochloric acid, and 10 litres water); (*b*) five-minute treatment, 1–10–1,500. In addition the following strengths were used: (*c*) 1–15–1,500, dipped five minutes; (*d*) 1–25–1,500, dipped five minutes; (*e*) 2–20–1,000, dipped eighty minutes.

Exact data were obtained only from the Gore and Ashburton experiments, and these are presented in tabular form as follows:—

Table 1.—Total Weight of Tubers dug; Variety, Arran Chief.

Treatment.	Gore.		Ashburton.	
	Number of Sets planted.	Weight of Tubers dug.	Number of Sets planted.	Weight of Tubers dug.
		lb.		lb.
Control	220	269	200	157
Treatment *a*	440	502	150	226
Control	209	299	200	310
Treatment *b*	418	521	400	683
Control	209	208	200	313
Treatment *c*	418	399	400	580
Control	220	213	200	291
Treatment *d*	440	376	400	585
Control	220	189	200	296
Treatment *e*	440	79	..	..
Control	220	169	..	..

Table 2.—Infection of Tubers with Sclerotia of Corticium-disease, Ashburton.
Sample of 100 seed-size tubers from each lot washed and examined.

Treatment.	Number of Tubers severely infected (Large Sclerotia).	Tubers slightly infected (Minute Sclerotia and Traces).	Clean Seed.
Treatment *a*	52	47	1
Treatment *b*	25	73	2
Treatment *c*	25	72	3
Treatment *d*	18	79	3
Control (*a*)	39	62	..
Control (*d*)	33	67	..

Table 3.—Infection of Tubers with Sclerotia of Corticium-disease, Gore.
Sample of 10 lb. of tubers from each lot washed and examined.

Treatment.	Severely infected.	Slightly infected.	Clean.
Control	187	79	10
Treatment *a*	22	10	209
Control	168	62	2
Treatment *b*	115	36	88
Control	175	81	2
Treatment *c*	68	35	171
Control	209	21	15
Treatment *d*	51	13	203
Control	211	107	9
Treatment *e*	11	6	260

COMMENT AND ADVICE FOR GROWERS.

It will be seen from the data here presented that the acidulated corrosive sublimate method, though giving excellent results in the laboratory, failed to control corticium-disease in the field. At the strengths and times recommended in the previous *Journal* article the dip does not materially affect the yield, nor, as the tables show, does any damage result with solutions of a much greater concentration; but if the tubers are exposed for a much longer time to the action of the solution serious damage may result.

For these reasons potato-growers are advised not to treat their seed tubers by this method. Experiments are now in hand with other methods of combating this important disease, but until one of them proves a success under practical farm conditions we can only advise that lines showing heavy infestation of sclerotia should be rejected for seed purposes.

For assistance in carrying out this year's experiments at the several farms or experimental areas mentioned the writers are indebted to Messrs. McGillivray, Sleeman, Hadfield, McKay, McKenzie, Shepherd, and Wards respectively.

Importation of Live-stock.—Consequent on the continued prevalence of foot-and-mouth disease in Great Britain, the embargo placed on the importation of cattle, sheep, and swine from there remained in force during the official year 1925–26. Some swine for stud purposes, also sheep, were introduced from those Australian States from which the importation is permitted, and some Jersey cattle from the United States, after having been domiciled for some months in Canada, arrived and underwent the required quarantine period. A number of horses (thoroughbreds and Clydesdales) were imported from Great Britain, and as an extra precaution against the possible introduction of foot-and-mouth disease they were all subjected to a period of quarantine. The introduction of dogs from the British Isles was considerably heavier than has been the case for some years. The following is a summary of the various classes of animals that were entered into quarantine during the year: Horses, 31; cattle, 15; swine, 38; sheep, 17; dogs, 154; fowls, 6.

Registration of Dairies.—In 1925–26 4,194 dairies for the supply of milk for direct public consumption were registered and inspected by the Live-stock Division throughout the Dominion.

FARMERS' FIELD-CROP COMPETITIONS.

TARANAKI - WANGANUI DISTRICTS, SEASON 1925–26.

J. W. DEEM, Instructor in Agriculture, Wanganui.

FARMERS' field-crop competitions were carried out in twelve centres of the Taranaki-Wanganui districts during last season, against thirteen in 1924–25, Auroa failing to obtain sufficient entries to compete in the former period. Judging, by the writer, was commenced on 20th May and finished on 22nd June. The general average weight of crops was better than in 1924–25, and this may safely be attributed to better cultivation. The total number of crops judged was 254, against 263 in the preceding season. They consisted of—mangolds, 98; carrots, 57; swedes, 51; lucerne, 26; and soft turnips, 21. The lucerne and soft turnips were judged in February. As usual, exhibits of the placed crops were staged at the Hawera Winter Show.

MANGOLDS.

The season of 1925–26 was not very favourable for mangold-growing. The wet, cold spring, followed by a sharp, dry spell in November, was not good for germination. Many farmers reworked their land and made fresh sowings, with the result that a great number of crops were late and had only a short growing season. The fact that the ninety-eight crops judged averaged 59 tons 14 cwt. per acre, against an average of 56 tons 18 cwt. in the preceding year—an increase of 2 tons 16 cwt. per acre—can be attributed to better methods in cultivation and manuring.

Varieties.

Prizewinner again stands out very prominently among the varieties grown, and of the ninety-eight crops thirty-seven were of this variety, with an average weight of 62 tons 14 cwt. Twenty of the crops judged went 70 tons per acre or over, and of these fifteen were Prizewinner and one a mixture containing Prizewinner. Giant Orange Globe was also popular on account of its good showing in the previous year, and twenty-eight crops of this variety averaged 56 tons 3 cwt. per acre. Mixed varieties, chiefly Prizewinner mixed with some other variety, were the next largest entry, fourteen crops averaging 55 tons 3 cwt. per acre. Other varieties grown were Jersey Queen, five crops averaging 49 tons 8 cwt.; Long Red, four crops averaging 39 tons 14 cwt.; White Sugar, three crops averaging 59 tons 13 cwt.; Yellow Globe, three crops averaging 63 tons 9 cwt.; White Knight, two crops averaging 53 tons 5 cwt.; and Golden Tankard, one crop, 40 tons.

Twelve competitions were judged, and in these Prizewinner was placed first in seven, second in six, third in five, and fourth in five. Giant Orange Globe was placed first in two, second in two, third in three, and fourth in three. Mixed varieties were placed first in three, second in one, third in three, and fourth in three. The other minor places were filled by a number of varieties.

Championship Crops.

Particulars of the championship crops, winning the Sutton Cups in their respective districts, are as follows:—

J. B. Hine, Toko, North Taranaki: ½ acre, after mangolds. Ploughed in June, and well cultivated before and after sowing. Variety, Sutton's Prizewinner; 6 lb. seed per acre, in 21 in. drills; sown 4th November with 8 cwt. super and 10 cwt. salt per acre. Yield of crop, 111 tons 13 cwt. per acre.

C. Willis, Matapu, South Taranaki: ½ acre, after grass. Ploughed in August. Cross and Son's Giant Orange Globe seed, at rate of 5 lb. per acre, in 18 in. drills; sown middle of October with 3 cwt. mangold-manure. Yield, 87 tons.

E. Parsons, Waitotara, Wanganui: 1 acre, after lucerne. Ploughed in June, and continuously worked as required till sown on 1st November with Sutton's Prizewinner seed, at rate of 7 lb. per acre, in 25 in. drills. Manure used, 5½ cwt. super, 1½ cwt. bone, ¼ cwt. sulphate of potash. Yield, 86 tons 5 cwt.

Other good crops were—83 tons 5 cwt., grown by J. Dakers, Kaupokonui; 83 tons 1 cwt., by Evan Jones, Toko; 81 tons 12 cwt., by H. Birch; and 81 tons 8 cwt., by E. Collins, both of Maxwelltown.

Date of Sowing, Width of Drills, and Amount of Seed per Acre.

Here a considerable variation is found, but, taking a line from the best crops grown, the following practice would appear to give the best results: Seed, 5 lb. to 7 lb. per acre; drills, 21 in. to 26 in.; sowing, the last week in October or first week in November. Some of the heaviest crops were grown in 18 in. drills, but these entail so much hand labour that it is doubtful if the extra yield compensates for the trouble.

Manures.

The competitions again emphasized the fact that any good phosphatic manure supplied in fair quantities will give good results. For instance, four crops were grown with superphosphate plus kainit or salt, and these averaged 77 tons 19 cwt.; twelve crops had super and bone, with an average weight of 68 tons 6 cwt.; fourteen crops were grown with super, bone, and potash, averaging 55 tons 2 cwt.; fifty-two crops had proprietary special manures and averaged 53 tons 18 cwt.; and five crops with a complete manure averaged 48 tons 19 cwt. From these figures it would appear as though the reduction of the phosphatic manure and addition of potash does not show any marked beneficial results. The alternative use of salt or potash is also interesting. Eight crops grown with salt added to the phosphatic manure yielded 63 tons 2 cwt., while twenty-three crops that had potash added in some form yielded 56 tons 2 cwt. From this it would appear that salt will give as good results as potash, and in some cases better. When it is considered that "spent" salt can be obtained for about £3 10s. per ton it would appear to be good practice to apply some to mangold ground, or, when choosing a potash manure, to use kainit or 30 per cent. potash, which contain large quantities of salt.

Table 1, giving the results of the twenty best crops, is of interest. In working out the cost of the manures the following prices, taken as an average throughout the districts concerned, were used: Super, £6 10s. per ton; basic super, £6; half super and half bone, £9; super, bone, and potash, £10; proprietary manure, £8 10s.; kainit, £6; sulphate of potash, £18; complete manure, £11; and spent salt, £3 10s.

Table 1.—Twenty Best Mangold Crops.

Variety.	Yield per Acre.	Date sown.	Width of Drills.	Amount of Seed.	Weight of Manure.	Particulars of Manure.	Cost per Acre.	Cost per Ton of Crop.	Remarks.
	Tons cwt.		Inches.	lb.	Cwt.		£ s. d.	d.	
Prizewinner ..	111 13	4/11/25	21	6	8	8 cwt. super, plus 10 cwt. salt	4 7 0	$9\frac{1}{3}$	Second crop of mangolds after cowyard.
Orange Globe ..	87 0	26/10/25	18	5	3	Mangold-manure	1 5 6	$3\frac{1}{2}$	After grass.
Prizewinner ..	86 5	1/11/25	25	7	$7\frac{1}{4}$	$5\frac{1}{2}$ cwt. super, $1\frac{1}{2}$ cwt. bone, $\frac{1}{4}$ cwt. sulphate of potash	2 18 3	$8\frac{1}{10}$	After lucerne.
Prizewinner ..	83 5	20/10/25	21	5	4	Mangold-manure	1 14 0	$4\frac{9}{10}$	After grass.
Prizewinner ..	83 1	30/10/25	22	7	7	Mixed manure	2 19 6	$6\frac{6}{10}$	After grass.
Prizewinner ..	82 14	26/10/25	21	6	10	Mangold-manure	4 5 0	$12\frac{1}{3}$	After grass.
Prizewinner ..	81 8	20/10/25	24	6	6	Half bone, half super ..	2 14 0	8	After oats.
Prizewinner ..	78 18	25/10/25	21	8	8	Half bone, half super ..	3 12 0	$10\frac{9}{10}$	After artichokes.
Orange Globe ..	77 8	22/10/25	28	6	5	1 nitrate soda, 4 equal parts super, slag, and bone	3 10 0	$10\frac{9}{10}$	After grass.
Prizewinner ..	76 6	29/10/25	20	4	8	Bone and super	3 12 0	$11\frac{3}{10}$	After grass.
Prizewinner ..	76 4	5/11/25	26	5	10	6 cwt. kainit, 4 cwt. mangold-manure	3 10 0	11	After potatoes.
Prizewinner ..	74 1	4/11/25	28	5	4	Mangold-manure	1 14 0	$5\frac{1}{2}$	After grass.
Prizewinner ..	73 19	20/10/25	24	6	6	Bone and super	2 14 0	$8\frac{3}{4}$	After oats.
Prizewinner ..	73 8	27/10/25	24	8	4	Super and kainit	1 5 0	$4\frac{1}{10}$	After rape.
Prizewinner ..	72 15	4/11/25	25	6	7	3 cwt. kainit, 4 cwt. mangold	2 12 0	$8\frac{6}{10}$	After peas.
White Sugar ..	72 1	20/10/25	21	6	7	3 cwt. kainit, 3 cwt. super, 1 cwt. guano	2 3 6	$7\frac{1}{12}$	After carrots.
Prizewinner ..	71 15	15/11/25	18	5	5	Half super, half bone ..	2 5 0	$7\frac{1}{2}$	After mangolds.
Prizewinner ..	71 2	20/11/25	14	4	$7\frac{1}{2}$	$1\frac{1}{2}$ cwt. kainit, 6 cwt. mangold	3 0 0	$9\frac{4}{10}$	After grass.
Prizewinner and White Knight	70 1	23/10/25	21	6	5	Mangold-manure	2 2 6	$7\frac{3}{10}$	After Italian rye-grass.
Prizewinner ..	68 9	5/11/25	14	6	4	Mangold-manure	1 14 0	$5\frac{9}{10}$	After turnips.

CARROTS.

The season was a fairly good one for this class of roots, the fifty-seven crops judged averaging 44 tons 12 cwt. per acre, compared with 41 tons 19 cwt. for the preceding season. The best crop was one grown by E. Parsons, Waitotara, of the Matchless White variety, that yielded 76 tons 14 cwt. per acre and won the Cooper Cup for best crop of carrots in the Wanganui district. This was a very fine crop of excellent quality, grown on an old lucerne stand, and showed the result of careful attention and cultivation. Another fine crop was grown by C. E. Billinghurst, Maxwelltown, variety Matchless White, 66 tons 9 cwt. The best crop in Taranaki was also of the Matchless White variety, grown by A. Ward, Okaiawa, 61 tons 2 cwt. per acre.

Varieties.

Matchless White again proved to be the most popular, thirty-three of the fifty-seven crops judged being of this variety, with an average yield of 48 tons 8 cwt. per acre. Mixed varieties, chiefly Matchless White mixed with some other variety, with eight crops, averaged 35 tons 1 cwt. Guerande, with four crops averaging 51 tons 3 cwt., did very well. So popular is this carrot becoming for sheep-feeding that next year the Maxwelltown centre intends holding a special competition for the variety. Other varieties grown were Sinclair's Champion, four crops averaging 39 tons 17 cwt.; Barriball, three crops averaging 32 tons 3 cwt.; White Belgian, two crops averaging 35 tons 1 cwt.; Magnum Bonum, one crop of 46 tons 6 cwt.; Holmes Improved, one crop of 39 tons 15 cwt.; and Yellow Intermediate, one crop of 27 tons 3 cwt. per acre.

Of the eleven competitions judged Matchless White won nine, was second in eight, third in five, and fourth in four. Mixed varieties won two, were third in one, and fourth in one; the minor places being filled by a number of the other varieties.

Best Crops.

E. Parsons, Waitotara: 1 acre, after lucerne; ploughed in June; sown 1st November with 1¼ lb. of Sutton's Matchless White seed, in 25 in. drills; manure used, 3 cwt. super, 1 cwt. bone, and ¾ cwt. sulphate of potash; yield, 76 tons 4 cwt.

C. E. Billinghurst, Maxwelltown: ½ acre, after mangolds; ploughed middle of October; sown 30th October with 1 lb. Matchless White, in 24 in. drills; manure, 4 cwt. super and bone; yield, 66 tons 9 cwt.

Reardon Bros., Maxwelltown: Ploughed middle of June, out of grass; sown 26th October with 2 lb. Matchless White seed and 5 cwt. super, in 24 in. drills; yield, 65 tons 16 cwt.

Date of Sowing, Width of Drills, and Amount of Seed.

As with mangolds, there is a considerable variation, but the following would appear to be fairly safe lines to work on: Sow during the last fortnight of October or first week of November, using 1 lb. to 1¼ lb. of seed per acre. Nearly all the heavy carrot crops were grown in 24 in. and 25 in. drills.

Manures.

Here again it is very evident that a fairly heavy dressing, 4 cwt. to 5 cwt., of a good phosphatic manure will satisfy the requirements

Table 2.—Twelve Best Carrot Crops.

Variety.	Yield per Acre.	Date sown.	Width of Drills.	Amount of Seed.	Weight of Manure.	Particulars of Manure.	Cost per Acre.	Cost per Ton of Crop.	Remarks.
	Tons cwt.		Inches.	lb.	Cwt.		£ s. d.	d.	
Matchless White ..	76 4	1/11/25	25	1¼	4¼	3 cwt. super, 1 cwt. bone, ¼ cwt. sulphate of potash	1 15 6	5 6/10	After old lucerne stand.
Matchless White ..	66 9	30/10/25	24	1	4	Half super, half bone ..	1 16 0	6½	After mangolds.
Matchless White ..	65 16	26/10/25	24	2	5	Super	1 12 6	6	After grass.
Matchless White ..	64 6	30/10/25	24	1	4	Half super, half bone ..	1 16 0	6 7/10	After mangolds.
Matchless White ..	61 2	8/11/25	21	1	4½	Special carrot-manure ..	1 18 3	7½	After oats.
Guerande	59 19	6/11/25	14	1¼	5	4 cwt. super, 1 cwt. bone ..	1 16 0	7⅕	After mangolds.
Matchless White ..	59 6	26/10/25	24	2	5	Super	1 12 6	6½	After grass.
Matchless White ..	59 6	..	18	1	4	Super and kainit	1 5 0	5 1/10	After rape.
Matchless White ..	56 9	30/10/25	28	1	5	Mangold-manure	2 2 6	9	After mangolds.
Matchless White ..	55 16	23/10/25	14	1	3	Special root-manure ..	1 5 6	5½	After grass.
Matchless White ..	54 11	7/11/25	14	1	2½	Special carrot-manure ..	1 1 3	4 7/10	New land.
Guerande	54 3	4/11/25	22	1½	4	Super and bone	1 16 0	7 9/10	After grass.

Table 3.—Ten Best Swede Crops.

Variety.	Yield per Acre.	Date sown.	Width of Drills.	Amount of Seed.	Weight of Manure.	Particulars of Manure.	Cost per Acre.	Cost per Ton of Crop.	Remarks.
	Tons cwt.		Inches.	lb.	Cwt.		£ s. d.	d.	
Superlative ..	69 8	20/12/25	14	1	3	Basic super	0 18 0	3 1/10	New land.
Grandmaster ..	65 10	23/11/25	7	1	3	Special root-manure ..	1 5 6	4 7/10	New land.
				Oz.					
Superlative ..	60 11	17/12/25	7	9	5	Mixed manure	2 2 6	8 4/10	After lea.
Magnum Bonum ..	60 1	28/11/25	14	11	3	Turnip-manure	1 5 6	5 1/10	After lea.
Grandmaster and Superlative	57 17	15/12/25	7	16	3	Turnip-manure	1 5 6	5 3/10	After lea.
Superlative ..	52 7	8/1/26	14	7	2	Super	0 13 0	3	New land.
Webb's Masterpiece ..	51 18	31/12/25	14	12	3	Basic super	0 18 0	4 1/10	Lea.
Grandmaster ..	51 11	5/12/25	14	11	3½	Bone, super, and potash ..	1 15 0	8 1/10	Lea.
Grandmaster ..	51 2	..	7	11	3	Turnip-manure	1 5 6	6	New land.
Grandmaster and Superlative	50 18	8/1/26	14	7	2	Super	0 13 0	3 1/10	New land.

of the carrot crop. It is often stated that carrots do not require a heavy dressing of manure, but the figures from the past season's competitions do not bear this out. Four crops were grown with 2 cwt. of manure and averaged 34 tons 2 cwt. in yield, ten used 3 cwt. and averaged 43 tons 6 cwt., twenty-four used 4 cwt. and averaged 43 tons 10 cwt., and eleven used 5 cwt., averaging 53 tons 7 cwt. Whether potash should be used or not is another debatable point. In the past season ten crops were grown using a phosphatic manure plus some form of potash, and these averaged 43 tons 9 cwt., while twenty crops grown with only a phosphatic manure averaged 47 tons 9 cwt. The best type of manure to use would appear to be super and bone. Ten crops grown with this mixture averaged 49 tons 19 cwt. per acre, compared with ten crops using super only, averaging 45 tons 3 cwt.; seven crops using super, bone, and potash averaging 46 tons 7 cwt.; twenty-seven crops using proprietary manures averaging 42 tons 18 cwt.; and three crops using a complete manure averaging 37 tons 6 cwt.

SWEDES.

The season was particularly favourable for the swede crop, and it was very pleasing to note the almost entire absence of dry-rot. Whether this is due to the disease running out after a cycle of years, or whether the seasonal conditions were responsible, is hard to say. However, if the same results are obtained again next year it is safe to say that the swede will in all probability come back to its former popularity in Taranaki. Fifty-one crops were weighed, with an average weight of 41 tons 6 cwt., as against twenty-six crops in the previous season, with an average weight of 39 tons 10 cwt.

Varieties.

Grandmaster proved the most popular variety, nineteen crops averaging 45 tons 5 cwt. Mixed varieties came next with seven crops averaging 37 tons 17 cwt., followed by Superlative with six crops with the fine average weight of 49 tons 15 cwt. Other varieties grown were Masterpiece, Crimson King, Magnum Bonum, Knockdon, Monarch, and Champion. Of the six competitions judged Grandmaster won three, was second in four, third in three, and fourth in five; Superlative won one, was second in one, and third in one; Masterpiece won two, and was third in one; the minor places being filled by a number of the other varieties.

Best Crops.

A. Marfell, Toko: 6 acres of virgin land; ploughed first week in November and well worked; sown 20th December with Garton's Superlative, 12 oz. of seed per acre, in 14 in. drills, with 3 cwt. basic super; yield, 69 tons 8 cwt. per acre.

James Bolger, Mangatoki: 2 acres, after grass; ploughed 8th November and well worked; sown 23rd November, in 7 in. drills, with 1 lb. Grandmaster and 3 cwt. special root-manure; yield, 65 tons 10 cwt.

Evan Jones, Toko: 10 acres; ploughed November, and sown 17th December, in 7 in. drills, with 9 oz. Garton's Superlative and 5 cwt. mixed manure; yield, 60 tons 11 cwt.

Time to Sow, Width of Drills, and Amount of Seed.

The best time to sow swede crops would appear to cover a fairly wide range if the results obtained in the competitions are to be taken as a guide. However, it would be safe to say that the first fortnight of December is the safest time. Where the grass-grub beetle is bad, however, the sowing is best delayed till about the middle of December. Nineteen crops were sown in 7 in. drills, averaging 43 tons 14 cwt. per acre, and twenty-seven crops in 14 in. drills, averaging 42 tons 16 cwt. One of the best crops seen, however, was grown in 25 in. drills and intercultivated like a mangold crop. It is just questionable if it would not pay farmers to do this and give their swede crops better attention. The amount of seed to sow should be about 12 oz. per acre, varying an ounce or so either way.

Manures.

The best average weight per acre was obtained from the use of 3 cwt. of manure; fifteen crops using this weight averaged 47 tons 8 cwt. in yield, eleven crops using 2 cwt. averaged 43 tons 14 cwt., ten using 2½ cwt. averaged 39 tons 4 cwt., three using 3½ cwt. averaged 43 tons 10 cwt., and four using 5 cwt. averaged 41 tons 18 cwt. The best return was obtained from the use of basic super, but there were only two crops using this manure, and they averaged 60 tons 13 cwt. Seven crops using super and bone averaged 44 tons 12 cwt., twenty-three using proprietary manures averaged 43 tons 6 cwt., four using super averaged 40 tons 3 cwt., and thirteen using super, bone, and potash averaged 37 tons 13 cwt. Here also it would appear that the reduction of the phosphatic manure and addition of some potash fails to show the benefit claimed for the latter fertilizer. Thirty-six crops grown without potash averaged 44 tons 3 cwt., whereas thirteen crops with potash averaged 37 tons 13 cwt.

SOFT TURNIPS.

The number of soft-turnip crops judged showed a slight increase —twenty-two, as compared with sixteen the previous year—but the average weight showed a decrease from 40 tons per acre to 36 tons, due partly to the dry spell after sowing. Club-root and soft-root were again in evidence, but not quite so bad as in previous years.

Red Paragon, Hardy and Imperial Green Globe, and Greystone were the most popular varieties. The best crop was one of Red Paragon, grown by C. Brock, Mangitoki, that yielded 45 tons 12 cwt. per acre. Most of the crops were grown with from 10 oz. to 12 oz. of seed and 2 cwt. to 3 cwt. of manure.

Nearly all the best crops were grown in 14 in. drills, using 12 oz. of seed. November or early December for sowing gave the best results.

Best Crops.

C. Brock, Mangatoki: 1 acre, after grass; ploughed middle of July; sown 30th December with 12 oz. of Red Paragon seed, in 16 in. drills; manure, 2 cwt. super, 1 cwt. bone, and ¼ cwt. sulphate of potash; yield, 45 tons 12 cwt.

J. W. Cleaver, Mangatoki: 1½ acres, after mangolds; ploughed middle of October; sown 18th November with 10 oz. Devonshire

Greystone and Red Paragon, in 14 in. drills; manure, 3 cwt. basic super per acre; yield, 45 tons 9 cwt.

A. Baker, Mangatoki: 1 acre, after grass; ploughed 24th October; sown 17th November, and resown 7th December, with 8 oz. Red Paragon, Hardy Green Globe, and Devonshire Greystone; manure, 3 cwt. basic super; yield, 45 tons 6 cwt.

Manures.

Best results were obtained from the use of 3 cwt. per acre of super or basic super, and here again the benefit, if any, derived from the use of potash is very doubtful. As the crop has a short growing-period the wisdom of using a readily available manure, such as super or basic super, will be easily seen.

LUCERNE.

The number of entries in the lucerne competition was slightly less than in previous years, due to the dry spell causing farmers to cut the crop for green feed at all stages of growth.

The best crop was entered by J. Clague, Manaia, whose very fine stand scored 49 out of a possible 50 points. This stand was sown on 7th December, 1923, in 7 in. drills, using 25 lb. of Marlborough seed per acre. It received 1 ton of lime per acre before sowing, and 1 ton in 1925. In 1924 it received 2 cwt. of slag per acre, and in 1925 2 cwt. of super per acre.

Another very fine stand was that of the Waimate West Demonstration Farm, sown on 8th December, 1920, in various drill-widths, with 15 lb. of Marlborough seed per acre; 5 cwt. of burnt lime was applied be o e sowing, and ½ ton of carbonate of lime was applied in 1925. Manure used was at the rate of 3 cwt per acre, and consisted of trials between slag, basic super, and Ephos phosphate. This crop scored 48½ points out of 50.

TUBERCULIN TESTING OF CATTLE.

REPORTING on work at the Wallaceville Veterinary Laboratory during 1925–26 the Officer in Charge (Mr. C. S. M. Hopkirk) refers briefly to trials of various methods of testing as follows:—

"Following a report on intradermal testing of cattle, published by the Medical Research Council, advantage was taken of the presence of a number of cattle on the farm to try out tuberculin tests as far as possible with material to hand. It was found that: (1.) Intradermal testing had no advantages in accuracy over the usual subcutaneous method. (2.) That the time employed in carrying out the double test made the test impracticable in the field. (3.) The test could not be employed easily in the modern bail. (4.) The usual caudal fold test was more easily applied, and gave results just as reliable. (5.) Experience was required to read an intradermal test. (6.) Sloughing or serious leaking through the skin occurred often at the seat of inoculation. (7.) Intradermal reactions were not decisive when given too closely together as regards time. In this it was as unreliable as the subcutaneous method. The Calmette ophthalmic method was found to be quite as reliable as other methods, and also had the advantage that it would give results even after several inoculations by other methods. The experiment suggested the wisdom of using more than one test in doubtful cases of tuberculosis."

WAIMAUNGA EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1925–26.

C. S. DALGLIESH, Fields Instructor, Waimaunga, Grey County.

DAIRYING was established at the Waimaunga Farm by the transfer thereto in May, 1925, of a Jersey-Guernsey grade herd from the Moumahaki Experimental Farm. Later a purebred Jersey bull, Tolgrath Pretty Master, was purchased to head the herd. This bull's sire is Meadowvale Taskmaster and his dam Holly Oak's Pretty, several good butterfat-producing strains appearing in the pedigree. A four-cow milking plant was also installed.

The winter of 1925 being mild the herd wintered well, but a most unwelcome change took place at the latter end of August, September proving wet, stormy, and continuously cold, with two light falls of snow—an exceptional event on this coast. Weather conditions continued very much against dairying right to the end of the year, and, indeed, very little summer was experienced. Despite a plentiful supply of forage—oats and vetches, oat and pea hay, and ensilage—during September, all stock went severely back in condition, and carried the effects of this cold, rough spell more or less through the season. Rough weather was experienced in December, culminating in a very heavy flood, which did not improve conditions. Pastures were quite a month later than usual in growth, and it was not until January that anything like a good sole was obtained. May saw another stormy spell of weather, and again a heavy flood.

LIVE-STOCK RETURNS.

Twenty-one cows and nine heifers were milked through the season. No supplementary feed was supplied except during the cold, rough weather in September, and a few loads of hay at the roughest period in May last. The average return of butterfat per cow for the season was 244·73 lb. Doubtless increased feeding with supplementary forage crops during the autumn would have increased the returns, but it was desired to get an idea of what this class of land would produce under the treatment already carried out on the pasture. The herd was tested regularly each month. In addition to the milking-herd, eighteen head of dry stock were carried.

The small flock of ewes, consisting of eighty-two three-quarter-bred Romneys mated with Border Leicester rams, gave satisfactory results in wool and lambs. The ewes clipped an average of 8½ lb. of wool, which realized 12½d. per pound at Christchurch. A truck-load of seventy-five fat lambs was sent forward to Addington market at the end of March last and averaged £1 10s. 6d. per head. The flock also gave an indirect return through grazing on pastures which were not at all suitable for dairying purposes. A small flock on a moderate-sized dairy farm such as this (150 acres) is quite useful for cleaning up weeds and feed that dairy stock will not eat

CROPS.

Four acres of Garton oats and common vetches, sown at the rate of $1\frac{1}{2}$ bushels oats and $\frac{3}{4}$ bushel vetches per acre; 3 acres of Garton oats and field-peas, sown at $1\frac{1}{2}$ bushels oats and 2 bushels peas; and 1 acre of Garton oats and Early Minto peas, were sown for hay crops, $1\frac{1}{2}$ cwt. of superphosphate being used for manurial purposes. Applications of 5 cwt., $\frac{1}{2}$ ton, and 1 ton of lime were made throughout the field; it can safely be said that on this class of land a ton of lime will give a threefold return over land not so treated.

Although this land was three times flooded, the difference in the treatments with lime were plainly to be seen in the growing crops and in the subsequent stubble after harvest. The oat and field-pea crop averaged $1\frac{3}{4}$ tons of hay, the oats and vetches $2\frac{1}{2}$ tons, and oats and Early Minto peas close on 2 tons per acre. Oats and peas make a much better hay crop here than do oats and vetches; the latter take too long to dry and are easily discoloured. In feeding either class of this hay to stock there is a good deal of waste, but more so with oats and vetches than oats and peas, Garton oats being inclined to grow strong on this land. Oats and vetches if manured with from $1\frac{1}{2}$ cwt. to 2 cwt. of fertilizers per acre on land that has been limed are almost sure to result in a heavy crop, which takes a considerable time to cure for hay. For ensilage purposes, on the other hand, the crop is ideal.

Areas of $1\frac{1}{4}$ acres of Superlative swedes for main-crop purposes, and 1 acre for experimental manurial trials in the control of mottled heart, were grown. Although wet-weather conditions generally, combined with floods, interfered with cultivation and retarded sowing, the crops were sown between 30th December and 2nd January, and have done well, quite a large proportion of roots ranging from 10 lb. to 16 lb. in weight. At time of writing crop weights are not available.

Six to seven acres of white- and yellow-fleshed turnips were sown on the flat, but have not proved a success. So far on this farm satisfactory results have not been obtained from turnip-growing under this method, a much better crop always being obtained when sown in ridges.

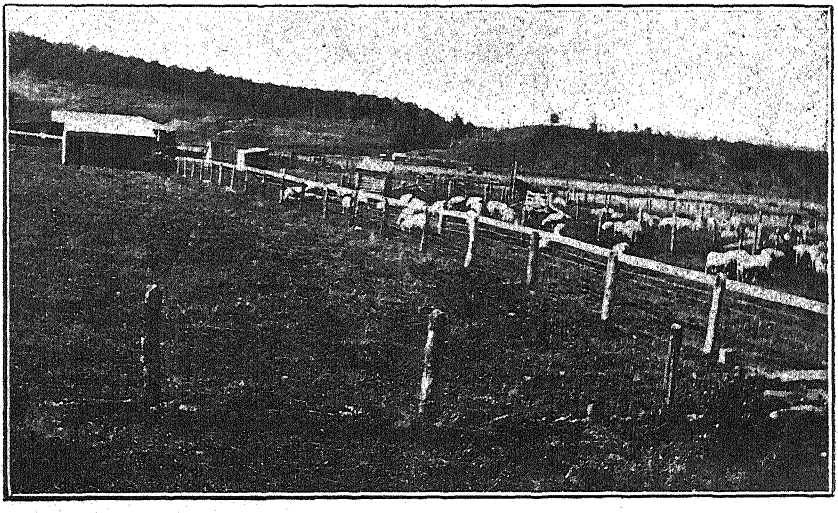
Half an acre of chou moellier was sown in raised drills on 2nd January last. Super and bonedust, equal parts, at the rate of 3 cwt. per acre, was used as a manure. Half the area was given in addition 1 cwt. of sulphate of ammonia per acre, which resulted in a much better yield and gave good colour to the crop. The crop as a whole, however, was not up to expectations, the date of sowing being rather late.

PASTURES.

The establishment of pastures on this farm has been dealt with in previous reports in the *Journal*. Field No. 1, sown in November, 1921; Field 3, sown in April, 1922; and Field 7, sown in December, 1923, were used for the grazing of the dairy herd during the milking-period. Taking a line on the carrying-capacity of these three fields, comprising 49 acres, with pastures in reasonably good condition and heart in average years, it will take $1\frac{1}{2}$ acres of pasture per cow for grazing during the milking-period on this class of land, following treatment such as has been given.

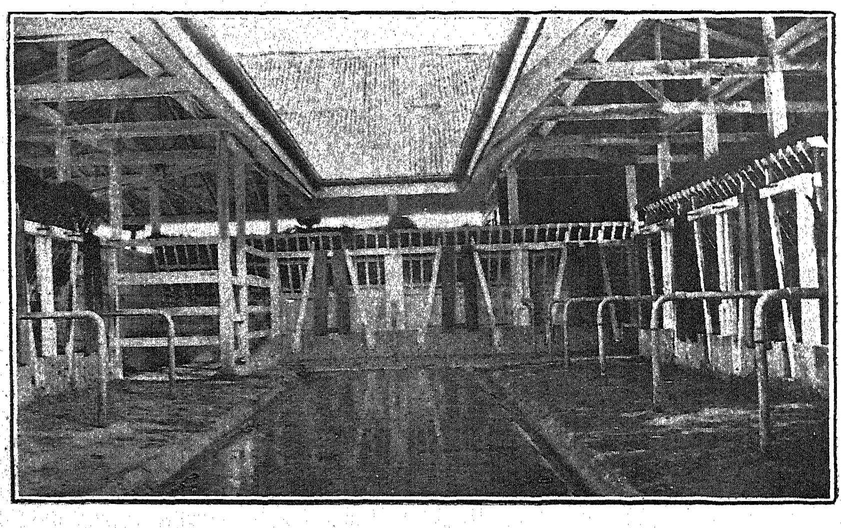
Although the pasture in Field 2 has reverted from a temporary pasture of Italian rye-grass and cow-grass, sown in the spring of 1922

to a sward of brown-top and sweet vernal, the area has proved interesting in regard to the carrying of stock. This field, together with Field 1—total, 33 acres—carried 180 dry sheep in good saleable condition from the early spring of 1924 to February, 1925. During the past season Field 2 (16 acres) carried 47 ewes and 54 lambs from lambing-time in September to the end of December. From the end of December to the 21st February these ewes and lambs, together with the remainder of



THE OPEN PIG-RUNS WITH MOVABLE HOUSES, ALSO CALF-HOUSE AND PADDOCK, AT WAIMAUNGA EXPERIMENTAL FARM.

The sheep seen are cleaning up pasture roughage.



MILKING-SHED AT WAIMAUNGA FARM.

the flock (total, 82 ewes and lambs), were grazed on Field 6, changing back occasionally to Field 2. Field 6 is old pasture land that has never been ploughed ; therefore the lambs were never on young pasture until 21st February, when they were put into young pasture and rape for fattening.

Although Field 2 was kept hard stocked, the chain-width strip in the centre which had not been limed always carried a roughage of feed, and at all times presented a dry, white appearance as compared with a healthy green pasture on the limed area. Brown-top and sweet vernal are low-producing pasture plants generally, but apparently where the fertility of the soil has been raised by applications of lime and manure these grasses are quite capable of making use of the added fertility.

Field 3 suffered considerably in the early spring from the grass-grub. This field, with crested dogstail dominant, was disappointing in its production of feed, despite the fact that it had been top-dressed during the winter of 1925, and hay and ensilage fed out on it to the dairy herd.

In contrast to this result the growth and colour of the pasture of the same field in the pig and calf sections were good, though no artificial fertilizers had been applied. The pigs on this farm are kept in open runs with movable houses, and within two months from the time they were first put in a noticeable improvement in the colour of the grass was visible ; likewise with the calf section. In November a half-chain strip in width was marked off in this field (No. 3), and the fresh slush and manure from the cowyard applied to it from time to time. The manure was filled every morning direct into a boxed sledge, and applied whenever the box was full. The result of this treatment was excellent, a good growth following. An interesting feature was the development of the different grasses. Although a liberal amount of cocksfoot was included in the mixture, this grass has not been prominent through the field, but is now showing up on the treated area quite markedly. The system of keeping pigs in open runs is evidently a good means of pasture-improvement on this type of land. The past season's experience convinces me that this system and the application of fresh manure from the cow-yard should be made extensive use of on the West Coast. The runs at this farm are fenced with pig netting and are made permanent. The erection of such fences so that they could be easily moved would, however, have several advantages.

The pasture in Field 7 has not been at all satisfactory. This area at time of sowing received lime in applications of 5 cwt., 10 cwt., 15 cwt., and 1 ton per acre. The heavier the application of lime the better has been the pasture, though the lighter dressings were quite right for the first year. Having been lightly stocked in 1924–25 this field was closed for haying last season, but owing to wet weather only part was cut. During the winter of 1925 the dairy cows and young stock were liberally fed on this field with hay, and, like Field 3, it had a very liberal dressing of cow-manure, which also was well scattered by tripod harrows. The results, however, were as disappointing as in Field 3. On the part of the field which had not been cut for hay but allowed to go to seed the dairy herd showed a very marked distaste for the pasture. The part cut for hay was kept closely grazed, while at the end of the season there was a good deal of roughage on the other part.

SWEDE VARIETY TRIAL IN CANTERBURY.

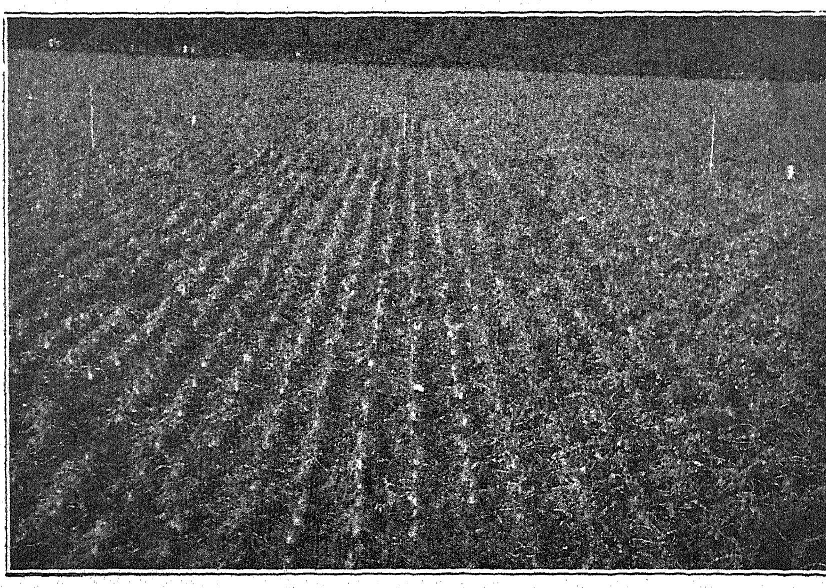
A. W. HUDSON, B.Ag., B.Sc., Instructor in Agriculture, Christchurch.

IN order to test the popular Superlative swede against varieties less commonly grown a trial was conducted last season on the farm of Mr. R. J. Low, Highbank (Ashburton County). The following varieties, with the exception of Nos. 1 and 2, were supplied by the New Zealand representative of D. Bell (Limited), and tried against Hurst's Superlative as a standard :—

(1.) Studsgaard Purple-top.
(2.) Wiboltts Danish Giant Purple-top.
(3.) Crimson King.
(4.) Bell's Mervue Purple-top.
(5.) Best of All.
(6.) Prima Donna.
(7.) Bell's Improved Purple-top.
(8.) Bell's Improved Bronze-top.

This series, with plots of the standard variety interspersed, was repeated eight times. The arrangement was such that no variety was separated from the standard with which it was compared by more than one intervening plot. For method of sowing and weighing plots in Canterbury experiments readers are referred to the *Journal* for July last, page 11.

Sowing was done in 14 in. drills at the rate of 12 oz. per acre. (Tests by the Department's Seed Analyst had shown all samples to have over 90 per cent. of germinable seeds.)



PORTION OF THE SWEDE VARIETY TRIAL PLOTS ON MR. LOW'S FARM.

Each plot four rows in width; only the two middle rows used for yield-determination. Poles mark standard (Superlative variety) plots. Other varieties run in order shown in list from right to left between outside poles (except middle plot). The crop tops are seen largely stripped by aphis and diamond-backed moth. [*Photo by E. M. Bates.*

A mixture of equal parts by weight of superphosphate and Ephos phosphate was sown through every coulter of the drill, so that half the manure fell in the seed rows and half between them.

The plots were weighed by Messrs. Calder, Bates, and Claridge on 24th June last, at which time the tops had almost entirely succumbed to the attacks of aphis and diamond-back moth.

The plots were inspected on 9th February last by Mr. F. E. Ward, who was of opinion that the seeding was rather heavy, but there were undoubted differences between the varieties in germination. At that time varieties Nos. 8, 4, and 7 appeared better than Superlative, No. 3 about equal, and Nos. 1, 2, 5, and 6 inferior. At the time of weighing, club-root had attacked some of the varieties, Crimson King being the worst in this respect, and Superlative the least affected.

The results of weighing are shown in the following table :—

Swede Variety Trial.

Area of individual weighed plot = $\frac{1}{778}$ acre. > = greater than.

Variety (other than Superlative).	Number of Paired Plots.	Yield per Acre.		Difference in Favour of Superlative.	Odds.
		Test Variety.	Superlative.		
		Tons.	Tons.	Tons.	
(1.) Studsgaard Purple-top	15	24·2	33·9	9·7	> 9,999
(2.) Wiboltts Danish Giant Purple-top	15	29·0	33·9	4·9	2,000
(3.) Crimson King ..	15	28·9	34·0	5·1	> 9,999
(4.) Bell's Mervue Purple-top	14	29·5	34·2	4·7	> 9,999
(5.) Best of All	14	30·3	33·8	3·5	1,300
(6.) Prima Donna ..	15	30·2	34·0	3·8	300
(7.) Bell's Improved Purple-top	16	27·0	33·5	6·5	> 9,999
(8.) Bell's Improved Bronze-top	16	30·1	33·5	3·4	171

It will be seen that the Superlative swede has proved superior to all other varieties under trial. It seems that the only way to overcome unevenness of germination is to sow thickly and thin plants to uniform distance apart.

Acknowledgments are due to Mr. Low for his keen co-operation, which enabled the work to be carried to a definite and satisfactory conclusion.

PEAR-MIDGE PARASITES.

THE Department of Agriculture has made arrangements for further supplies of *Platygaster* parasites of the pear-midge (*Perrisia pyri*) to be collected in Europe and shipped to New Zealand. The first and second consignments of these have now arrived, and are being held in cool storage until the midge becomes active. Several other consignments are also on the way.

From this material, and from that being reared in the insectary cage at Henderson from the consignments secured last year, it is expected that sufficient parasites will be on hand this season for establishing in the pear-midge-infected areas. A full account of the initiation of the work was published in the *Journal* for June last.

KING COUNTRY CO-OPERATIVE FIELD EXPERIMENTS.

WORK AT ARIA DURING 1925–26.*

J. E. F. JENKS, N.D.A., Assistant Instructor in Agriculture, Te Kuiti.

THE policy which is being pursued at the present time with regard to the Aria plots is that of grassing and top-dressing the bulk of the land. This policy is dictated partly by the difficulty of obtaining labour for cropping-work and partly by the fact that it is inadvisable to crop the typical light soil, of which the greater part of the area consists, for more than two or three seasons before giving it a spell on pasture.

Field A, which consists of flat land between the hill and the Kiokio Stream, was cleared and partially drained in the winter of 1925. Ploughing followed, but cultivation work was rendered difficult by reason of the excess of moisture. Mangolds were sown on 20th November with 3 cwt. of super and 1 cwt. of sulphate of ammonia per acre. Three strains of imported Danish varieties were tried—Wiboltts Sludstrup, Wiboltts Taarje, Wiboltts Dana—also three common varieties. Owing to the wet, indifferent tilth, germination was bad, and, though transplanting was carried out, the crop was so uneven that comparison between the different varieties was nearly impossible. In places the mangolds were excellent.

In an adjoining paddock two new Dutch varieties of soft turnip were tried. (1.) Mailand Early Flat Purple-top: This variety matures rapidly and sits well on the surface of the ground, so that it should commend itself both for carting off and grazing. The crown, however, is decidedly hollow, and it is evidently not a good keeper, so that its use will be mainly as a catch-crop. (2.) Osterundum medicum (Long Redhead) was not so quick to mature, but gave good promise.

Field B was treated in the same manner as Field A, and was sown with maize, half the area being planted in 7 in. and half in 14 in. drills. When fed out in March the cows showed a distinct preference for the slimmer stems of the 7 in. drills. Both these fields will be cropped with Japanese millet in the present season and sown with grass plots in the autumn.

Field E, a sideling partially reverted to bracken fern, was burnt over in April last and has been resown.

Field F.—The grass plots, alongside Field E, are establishing well in spite of the looseness of the soil and the invasion of bracken fern. The danthonia is making slow progress, but the paspalum is stooling out well, and the brown-top and subterranean clover are also satisfactory. Kikuyu-grass died right back during the winter, but came away again rapidly the following November, and was much relished by the stock. Planted 3 ft. apart, it is covering the ground well, and though unsuited for extensive areas (owing to the labour of planting) it should be useful for small areas of steep, light soil, even as far south as this.

* An initial article on the Aria plots, together with a sketch-plan of the experimental block showing the various fields, &c., was published in the *Journal* for March, 1925.

Field L has been sown in lucerne. A good crop of crimson clover and rye-corn (a good spring-feed mixture for this district) was turned under in October, and the lucerne-seed was sown on 21st November, together with 2½ cwt. of local inoculated soil, 3 cwt. super, and 1 cwt. of 30 per cent. potash per acre. The area sown with Marlborough seed germinated badly and was resown in March, but the Hunter River plot has grown comparatively well. The lucerne will have a hard fight to beat the sorrel and twitch, but it is hoped that by means of good manuring and cultivation the crop will be established. Generally speaking, King-country conditions are not favourable to the cultivation of lucerne.

Field M.—The grass plots in this field, sown in the autumn of 1925, have done well. They illustrate the value of early ploughing, rolling, and hand sowing, and covering with tine harrows rather than with chains. The mixtures used were as follows:—

Pasture Species.	Plot 1.	Plot 2.	Plot 3.	Plot 4.
	lb.	lb.	lb.	lb.
Italian rye-grass	6	4	4	4
Poverty Bay rye-grass	12	8	8	24
Cocksfoot (Akaroa)	8	14	14	..
Crested dogstail	..	3	..	3
Timothy	..	3	3	3
Cow-grass	4	4	4	4
White clover	1	1½	1½	1½
Lotus major	..	½	½	½
Danthonia pilosa	..	..	4	..
Total per acre	31	38	39	41
Approximate cost	£1 5s.	£1 15s.	£2 1s.	£1 8s.

The mixture sown in Plot 1 is one commonly used in the district. At the time of writing it is distinctly thinner than the others. On Plot 2 the rye-grass has been decreased and the cocksfoot increased with the addition of crested dogstail, timothy, and Lotus major. This mixture so far has proved superior. Danthonia pilosa was substituted for crested dogstail on Plot 3, and on Plot 4 the whole of the cocksfoot has been replaced by rye-grass.

Recreation-ground.—Plots on this adjoining area were top-dressed in July, 1925, under the following treatments: (1) Super, 4½ cwt., and lime, 10 cwt., per acre; (2) check; (3) super, 4½ cwt. per acre; (4) check; (5) slag, 4½ cwt. per acre.

The turf was very weak before the manure was applied, but improved greatly in the first year on all the manured plots. The cattle were constantly on these, and the herbage was grazed very close when there was apparently an abundance of feed on the rest of the field. Superphosphate, and super plus lime, both gave good results.

MANAGEMENT FOR LIGHT, UNDULATING KING-COUNTRY LANDS.

A good deal of useful information has now been gained from the Aria plots, and it is possible to lay down a policy suited to the light, open, undulating lands of the King-country with a certain degree of

confidence. First, it is evident that phosphatic manures are so essential that money is better spent on fertilizing country already grassed than on labour and seed for breaking in new areas. The actual need for lime and potash is still in doubt. Super and basic super should be the staple manures. Slag is good, but does not appear to be quite so effective. The aim should be to get as much as possible of the holding into regularly manured grass, consisting of cocksfoot, crested dogstail, and white clover, together with a certain amount of paspalum. Danthonia should also be sown as an insurance policy.

It is certainly desirable for the settler to do a limited amount of cropping for supplementary feed. For spring feed, Skinless barley, rye-corn, crimson clover, and Italian rye-grass are to be recommended; for late summer, Japanese millet and soft turnips; for autumn, soft turnips and chou moellier; for winter, chou moellier and swedes. Lucerne is hardly worth the constant labour that the wet climate involves. Mangolds may be grown on land of superior quality if sufficient labour is forthcoming. As much hay and ensilage as possible should be saved, more especially as the swede crop is becoming every year more uncertain.

PNEUMOMYCOSIS IN WHITE SWAN.

A WHITE swan which had died in one of the New Zealand inland town parks was received recently at the Wallaceville Laboratory for examination as to the cause of death. The bird had not been in good health for some time previously, and was poor and anæmic. Autopsy revealed caseous nodules throughout the lungs, and the air-sacs to be almost filled with a yellow, thick, fibrinous deposit. No bacteria were present in this material nor in the nodules of the lungs. The heart-blood was also free from pathogenic organisms. Further examination revealed plaques of mould-growth on the walls of the air-sacs which had become thickened from invasion by the mycelia. Each plaque had a diameter of from 1 cm. to 3 cm., and was white in colour round the edges, but darkened and green-tinged towards the centre. Smears from these areas showed spores of a mould, and cross-sections made from the plaques showed the typical spore arrangement of *Aspergillus fumigatus*. As this is the first case of its kind noted in New Zealand it seems worthy of being placed on record.

—*C. S. M. Hopkirk, B.V.Sc., Veterinary Laboratory, Wallaceville.*

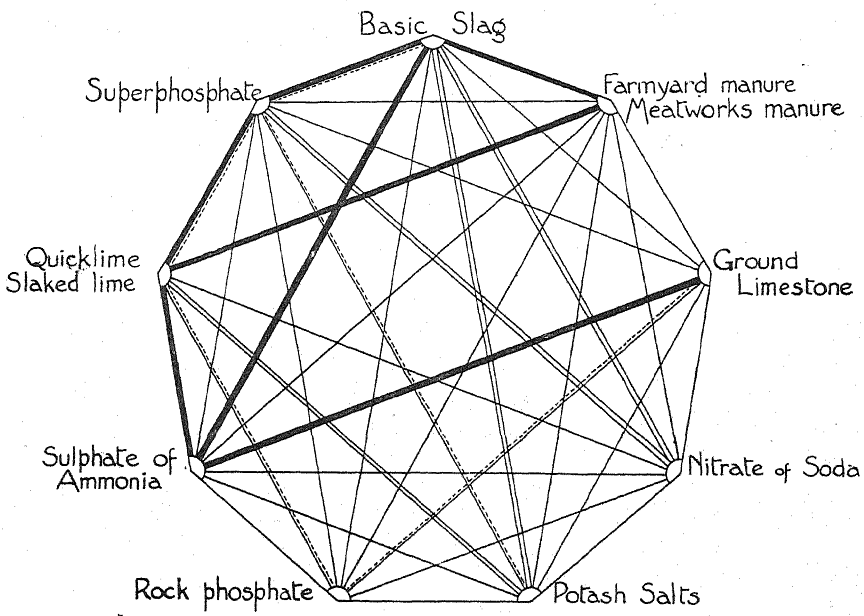
Blackberry-control Investigation.—Investigations into biological, chemical, and ecological methods of control or eradication of blackberry have been continued (states the annual report of the Fields Division for 1925–26), numerous field experiments having been laid down on the area of blackberry-infested land leased for experimental purposes in Wairoa County. Tests are also being made of top-dressing and sowing and the use of goats for the control of this weed. In Poverty Bay experiments in methods of control have been initiated on a larger scale. Here the co-operation of the owners of the land has been secured, and the practicability of employing various sprays is being demonstrated. One of these spray fluids, which is being made up according to improved methods devised in the laboratory, will no doubt prove of use for certain types of blackberry-infested land.

A FERTILIZER-MIXING CHART.

Chemistry Section.

SUBSTANCES joined by the thick line in the accompanying chart should not be mixed. Substances joined by double lines should not be mixed until just before using. Substances joined by the thin line may be mixed at any time. Where the dotted line is used to connect two fertilizers reference should be made to the following notes :—

Superphosphate and basic slag may be mixed just before sowing; if the mixture is allowed to stand it is liable to set to a hard mass.



FERTILIZER-MIXING CHART.

Superphosphate mixed with a certain amount of caustic lime is on the market under the name of basic super. About 15 per cent. of slaked lime will revert all the water-soluble phosphate in ordinary superphosphate to the dicalcic or citrate-soluble state. In case an excess of lime is present in basic super it is not advisable to mix this fertilizer with nitrogenous organic manures or sulphate of ammonia.

It is not advisable to mix superphosphate and kainit, the mixture being liable to form a sticky mass on standing. Other potash salts may be mixed safely with super.

Ground rock phosphate and lime should be applied in conjunction only after a field trial has shown that the results are better than those with rock phosphate alone.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING FACTORY AVERAGES FOR YEAR 1925-26.

Dairy Division.

FOLLOWING are lists of butter and cheese factories respectively, throughout the Dominion, that have obtained for their export produce an average grade of 92 points or over for the past dairy year, 1st August, 1925, to 31st July, 1926 :—

BUTTER-FACTORIES.

Name of Company.	Registered Number.	Brand.	Average Grade.
Wairoa	1345	Wairoa	94·701
Rangitikei	1360	Rangitikei	94·699
Awahuri	664	Red Rose	94·212
Levin	910	Lake	94·114
Kia Ora	926	Kia Ora	94·012
Tolaga Bay	1007	Tolaga Bay	93·950
Cheltenham	3	Pakeha	93·910
Taieri and Peninsula (Dunedin)	54	Taieri and Peninsula	93·836
Rangiwahia	750	Quail	93·806
Waitaki (Oamaru)	812	Waitaki	93·729
Raetihi	717	Raetihi	93·723
Shannon	1489	Shannon	93·720
Rata	938	Rata	93·621
Mauriceville	14	Mauriceville	93·586
Mangorei	345	Mangorei	93·560
Kuku	805	Ohau	93·500
Tikorangi	102	Shield	93·300
North Taranaki	723	Flax	93·270
Bay of Plenty	1399	Bay of Plenty	93·262
Heretaunga	1230	Heretaunga	93·215
New Zealand (Waharoa)	293	Anchor	93·177
Taihape	1188	Tikapu	93·140
Okoia	413	Okoia	93·107
Wangaehu	1326	Wangaehu	93·096
Piopio	603	Piopio	93·089
Port Albert	298	Port Albert	93·075
Uruti	300	Uruti	93·063
Rangitaiki Plains	133	Rangitaiki Plains	93·027
Midhirst	110	Rugby	93·026
Waitara	726	Waitara	93·018
New Zealand (Frankton Junction)	1510	Anchor	93·000
Farmers' Dairy Federation	336	Murihiku	92·991
Opotiki	337	Opotiki	92·955
Tarata	631	Tarata	92·937
Akaroa	1579	Akaroa	92·931
New Zealand (Te Awamutu)	1880	Anchor	92·925
Hikurangi	303	Hikurangi	92·915
East Tamaki	301	East Tamaki	92·909
Stratford	68	Good Luck; Three Star	92·900
Maketawa	342	M.D.C.	92·899
Cambridge	1239	Cambridge	92·886
Raglan	1470	Raglan	92·828
Tarurutangi	728	Champion	92·815
Moa Farmers	341	Inglewood	92·782
Oruru-Fairburn	1337	Fairy	92·731
New Zealand (Tuakau)	1320	Anchor	92·727

BUTTER-FACTORIES—*continued.*

Name of Company.	Registered Number.	Brand.	Average Grade.
New Zealand (Paerata) ..	109	Anchor	92·682
Tamaki	1463	Bell	92·660
West Coast Farmers	675	Silverpine	92·609
Waipukurau	1455	Dewdrop	92·595
Maungaturoto	1407	Maungaturoto	92·595
Kaipara	794	Poplar	92·593
Whangarei	1720	Kauri	92·582
Kaitieke	1119	Kaitieke	92·574
Bell Block	488	Bell Block	92·569
Kiwi	299	K.D.C.	92·564
Murchison	1888	Airship	92·542
Bay of Islands	1312	Bay of Islands	92·539
New Zealand (Ngatea) ..	291	Anchor	92·538
New Zealand (Waitoa) ..	91	Anchor, &c.	92·498
Northern Wairoa	1358	Northern Wairoa ..	92·488
Te Aroha	344	Overseas, &c.	92·480
Okitu	1270	Okitu	92·476
Lepperton	49	Lepperton	92·441
Kaitaia	1298	Kaitaia	92·441
Eltham	31	Eltham	92·437
New Zealand (Ngaruawahia) ..	22	Anchor	92·368
Tai Tapu	175	Tai Tapu	92·353
Kairanga	1768	Longburn	92·308
Rongotea	8	Rongotea	92·292
Maungatapere	1710	Moana	92·281
New Zealand (Otorohanga) ..	185	Anchor	92·274
Arahura	1516	Arahura	92·261
Kaikoura	302	Kai	92·258
Ruawai	66	Ruawai	92·234
Aria	1734	A.D.C.	92·229
New Zealand (Waihou) ..	1458	Anchor	92·219
Mercury Bay	485	Mercury Bay	92·217
Matakana	1375	British..	92·212
Ashburton	620	Ashburton	92·173
Masterton	1307	Masterton	92·167
Taieri and Peninsula (Oamaru)..	1234	Taieri and Peninsula ..	92·099
Kokatahi	1144	Kokatahi	92·081
Staveley	1719	Staveley	92·054
Manutahi	495	Manutahi	92·053
Hawke's Bay	169	Ahuriri; Clive	92·051
Rahui (Wellington Municipal) ..	202	Rahui	92·047
Rotorua	724	Geyser	92·006

CHEESE-FACTORIES.

Name of Company.	Registered Number.	Brand.	Average Grade.
Milton	1030	Milton	94·142
Te Horo	134	Allies	93·581
Tokoroa	255	Tokoroa	93·557
Dalefield	9	Dalefield	93·536
Omimi	74	Omimi..	93·505
Drummond	1823	Drummond	93·444
Mosgiel	161	Mosgiel	93·434
Pihama	627	Pihama	93·425
Pihama	1111	Pihama	93·335

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered Number.	Brand.	Average Grade.
Merton	45	Merton	93·291
Seaward Downs	702	Seaward Downs	93·256
Kuku	905	Ohau	93·197
Tuturau	132	Tuturau	93·158
Edendale	36	Edendale	93·128
Hauraki Plains	1900	Hauraki Plains	93·113
Rimu	1155	Rimu	93·094
Dannevirke	391	Dannevirke	93·070
Ashhurst	1886	Hinemoa	93·056
Staveley	1719	Staveley	93·041
Maungatua	1708	Maungatua	93·023
New Zealand (Rukuhia)	114	Anchor, &c.	92·963
Brydone	1821	Brydone	92·935
Morton Mains	1604	Morton Mains	92·923
Awarua	545	Awarua	92·922
Little Akaloa	32	Little Akaloa	92·898
Nireaha	335	Nireaha	92·893
Woodville	1892	Woodville	92·867
Island	72	Island	92·859
Alton	1890	Alton	92·815
Paretai	271	Paretai	92·798
Stirling	292	Stirling	92·798
Temuka	207	Ohape	92·798
Silverstream	62	Silverstream	92·752
Paraparaumu	167	Pram	92·743
Waiohiki	1681	Waiohiki	92·738
Whiterig	798	Whiterig	92·729
Waikouaiti	18	Waikouaiti	92·720
Woodlands	1485	Woodlands	92·712
Otautau	1610	Otautau	92·696
Parkvale	1240	Parkvale	92·696
Cambridge (Fencourt)	125	Cambridge	92·691
Mangatoki	136	Mangatoki	92·687
Ryal Bush	477	Ryal Bush	92·678
Takamatua	33	Takamatua	92·648
Browns	925	Browns	92·630
Oteramika	813	Oteramika	92·618
Tuatapere	804	Tuatapere	92·608
Bidwill	270	Bidwill	92·608
Fairfax	1004	Fairfax	92·606
Oroua Downs	94	Oroua Downs	92·606
Kai Iwi	1565	Kai Iwi	92·587
Boggy Burn	703	Boggy Burn	92·569
Pihama	1112	Pihama	92·564
Ashburton	81	Ashburton	92·547
Norfolk	1093	Norfolk	92·547
Gorge Road	567	Gorge Road	92·527
Bell Block	488	Bell Block	92·489
Lowgarth	629	Lowgarth	92·480
Maharahara	984	Maharahara	92·479
Orepuki	1744	Orepuki	92·474
Thornbury	1581	Thornbury	92·474
Tawaha	1722	Tawaha	92·470
Mataura	38	Mataura	92·436
Pembroke	234	Pembroke	92·435
Milford	267	Milford	92·429
Mokotua	67	Mokotua	92·401
Kairanga	182	Kairanga	92·362
North Tiraumea	1599	Kohinui	92·356
Cambridge (Monavale)	127	Cambridge	92·351

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered Number.	Brand.	Average Grade.
Waianiwa	1171	Waianiwa	92·344
Bainesse	808	Bainesse	92·339
Tatua	34	Tatua	92·329
Woodend	1586	Woodend	92·312
Newman	966	Newman	92·310
Wright's Bush	206	Wright's Bush	92·295
Menzies Ferry	623	Menzies Ferry	92·293
Makowhai	213	Makowhai	92·271
Kelso	1266	Kelso	92·269
Mata	258	Vale	92·250
Kiritaki	1521	Premier	92·244
Uruti	300	Uruti	92·240
Collingwood	1254	Collingwood	92·236
Manakau	815	Black Swan	92·226
Otamita	17	Otamita	92·222
Wyndham	59	Wyndham	92·219
Oware	662	Oware	92·218
Hukanui	27	Hukanui	92·210
Featherston	360	Featherston	92·197
Waimana	1817	Waimana	92·195
Takapau	75	Takapau	92·190
Rexdale	481	Rexdale	92·189
Tokomaru	972	Tokomaru	92·185
Opouriao	1169	Opouriao	92·183
Bruntwood	1534	Bruntwood	92·168
Lochiel	659	Lochiel	92·160
Manawatu	1189	Reliance	92·152
Tararua	444	Tararua	92·137
Pine Bush	543	Pine Bush	92·131
Kennington	205	Kennington	92·122
Tuna	209	Tuna	92·121
Ballance	1	Ballance	92·121
Tiakitahuna	1889	Tahuna	92·116
Henley	1627	Henley	92·094
Momona	1010	Allanton	92·094
Otahuti	231	Otahuti	92·093
New Zealand (Matamata) ..	318	Anchor, &c.	92·081
Kokotau	809	Kokotau	92·081
Collingwood	1742	Collingwood	92·075
New Zealand (Wharepoa) ..	173	Anchor, &c.	92·066
Pahiatua	140	Rival	92·055
Cambridge (Gricedale) ..	128	Cambridge	92·054
New Zealand (Eureka) ..	353	Anchor, &c.	92·052
Waihakeke	370	Waihakeke	92·050
T. L. Joll	1727	Maori Chief	92·049
Marima	195	Marima	92·047
Hamua	164	Hamua	92·034
Greytown	529	Greytown	92·027
Glen Oroua	906	Glen Oroua	92·008

Water Content of Export Butter.—During 1925–26 the system adopted by the Dairy Division of testing for moisture content one box of butter from every churning forwarded to the grading-stores was continued, a total of 127,753 churnings for export being thus tested. These showed an average water content of 15·200 per cent., which is slightly higher than the preceding year's average. No complaints were received from Britain regarding excess of water in New Zealand butter. The legal limit is 16 per cent.

SEASONAL NOTES.

THE FARM.

PASTURE-MANAGEMENT.

PASTURES will be making good growth during October, especially where fertilizers have been applied during winter or early spring, consequently good management during that month will influence to a great extent the utility of the pasture throughout the summer. Judicious grazing is the best control for the pasture, but if, later, there is any tendency to coarseness or running to seed the mower should be run over the field. It is the short, sweet grass that gives the return, both for sheep and dairy cows; if a pasture is allowed to get rough, production will drop. Permanent grass intended for hay may still be closed during October, but earlier closing results in a finer-quality hay; it also provides a succulent aftermath when it is most needed, about December or January.

FORAGE CROPS.

Rape and Kales.—In favourable districts the first sowing of rape can be made during the coming month, leaving the main crop till early November. It is always wise to sow the crop in breaks at intervals, according to local conditions, to give a continuous crop of maturing rape during the fattening-period. This avoids the danger of over-ripeness, and also helps to restrict the ravages of aphis if that pest attacks the crop.

Any of the kales can be sown in October to come in from the middle of January and beginning of February. Chou moellier is well adapted for this purpose. It is less susceptible to the attacks of blights and aphis than most cruciferous crops, and is resistant to club-root. It provides fine fodder for cows in late autumn, and may be fed right through winter. It is also excellent for wintering pigs. A suitable sowing is 1½ lb. per acre, with about 3 cwt. of superphosphate.

Soft Turnips.—These are very useful for cow-feeding or lamb-fattening early in the New Year. Among the best varieties are Red Paragon, Purple Mammoth, Devonshire Greystone, and Imperial and Hardy Green Globe. For cow-feeding it is best to sow about one-third of the area in Red Paragon and the remainder in one of the Green Globes. The Red Paragons can be fed first, and by the time they are finished the Green Globes should be in good condition for feeding. A good plan on new land is to sow on the flat. Where the land has been cropped and become foul with weeds it is best to sow on ridges 21 in. to 28 in. apart, so as to allow the crop to be intercultivated and cleaned. Rate of seeding is 10 oz. to 12 oz. on the flat and 1 lb. to 1½ lb. on ridges. Basic super makes a good manure for average soils.

Mangolds.—For late winter and early spring feeding for dairy cows and breeding-ewes mangolds are hard to beat. Among good varieties are Prizewinner, Giant Orange Globe, White Knight, White Sugar, and Red Intermediate. It is good practice to grow two varieties, and stock appear to like a change. Mangolds should be sown in drills 21 in. to 28 in. apart, so as to allow plenty of intercultivation with the horse-hoe. Sow at from 5 lb. to 6 lb. per acre and manure liberally, giving from

4 cwt. to 6 cwt. of a phosphatic manure, plus 3 cwt. of kainit or 3 cwt. to 5 cwt. of salt, per acre. The salt or kainit should be broadcasted and harrowed in a week or so before the seed is sown. If sown through the drill with the seed it delays germination. It is a good plan to soak mangold-seed for twenty-four hours in water, then spread it out in a shed to dry. It may be sown the following day, but is best left for a week, as it will then be near germinating and will come through the ground very quickly. This is a great advantage where weeds are bad. The system of sowing mangolds in special beds and transplanting out the plants is becoming increasingly popular. This method allows of much extra cultivation and killing of annual weeds before the crop is transplanted. Where grass-grubs and caterpillars are troublesome this method is again an advantage, in that the larger plants are not influenced by attacks.

Carrots.—This crop is one of the safest the farmer can grow. For cows Matchless White is still in the front rank, while for sheep Guerande gives excellent results. Carrots, like mangolds, require plenty of inter-cultivation, and where the area is over $\frac{1}{4}$ acre they are best sown in drills 18 in. to 28 in. apart. A suitable sowing is at the rate of 1 lb. to $1\frac{1}{4}$ lb. per acre. Manure recommended for mangolds is suitable for carrots, except that the kainit or salt may be reduced to 1 cwt. per acre or omitted altogether. An idea prevails in some parts that carrots will not stand heavy manuring, but this is not borne out by experience.

POTATOES.

The main crop can be planted during the coming month. Potatoes do best on loamy soils with plenty of organic matter, and with an inclination to siltiness rather than to heaviness. A fairly fine preparatory tilth is necessary. Care should be taken that the seed is free from disease. Common scab appears as a scab about $\frac{1}{8}$ in. deep and the size of a threepenny-piece or larger. Powdery scab in the young stage looks like a small blister; later these burst and appear in small patches of pustule; each pustule is about the size of a wheat-grain, with a crater-like appearance, and has broken, flappy edges which are raised slightly over a hollow centre containing brown powdery spores. Corticium is carried over on the tuber in what appears to be small patches of dirt; these are found to be hard, but are easily scraped off, showing dark brown underneath. This is a very common disease, though often not noticed, and causes more loss than is sometimes thought. Land known to have been infected with powdery scab in the preceding season should be avoided. A very useful manure for potatoes is 6 parts super, 1 part blood-and-bone, and 1 part sulphate of potash, applied at the rate of about 4 cwt. per acre.

CEREAL CROPS.

Spring sowing of cereals for grain will now be about over. In the case of autumn- or winter-sown crops, if sheep have been grazed thereon, the ground should be harrowed when they are removed, partly to aerate the roots and partly to break the surface cake and conserve moisture. Judicious feeding-off and harrowing will not reduce the yield of a tillering variety of oats or wheat, but rather produce a denser crop. Care must be taken, however, not to feed too late in the season.

CALIFORNIAN THISTLE.

In treating patches of Californian thistle on arable land the ground should be kept cultivated until March, never letting thistles appear on the surface Cultivation requires repeating about once a fortnight. A grubber having broad overlapping tines is a suitable implement to use for this purpose.

—*Fields Division.*

THE ORCHARD.

SPRAYING.

In last month's notes the programme outlined dealt with spraying up to the "petal-fall" period, and in some instances to the period two weeks later. The completed calendar for the season is now given below. Orchardists should order sufficient supplies of the various materials in good time so that they may be on hand when the applications are required to be made.

SPRAYING CALENDAR—*continued.*

Pest or Disease.	Spray to use.	Time of Application.	Remarks.
	Stone-fruits—continued.		
San Jose scale. Red mite. Black and green aphis.	(5.) Lime-sulphur, 1 in 125, plus 6 lb. precipitated sulphur, or Black Leaf 40, 1 in 800, and soap.	(5.) At intervals as required (frequently during early summer).	Important that spray should be applied as soon as aphis appears.
Cherry-slug.	(1 and 2.) Arsenate of lead, 3 lb. paste or 1½ lb. powder to 100 gallons.	(1.) As soon as fruit is picked if slug has made its appearance. (2.) Eighteen days later, if necessary.	
Bladder-plum. Brown-rot. Leaf-curl. Leaf-rust. Die-back. Shot-hole.	(4.) Lime-sulphur, 1 in 125, plus 6 lb. precipitated sulphur, or bordeaux, 3-4-50.	(4.) At intervals as required. (For brown-rot control apply sulphur spray at intervals of from eighteen to twenty-one days until fruit is harvested.)	Gather and destroy all brown-rot-affected fruits, together with portion of spurs to which they are attached.
	Pip-fruits—continued.		
Red mite. Woolly aphis. Scales.	(5.) Lime-sulphur, 1 in 100, plus 6 lb. precipitated sulphur, or Black Leaf 40, 1 in 800, and soap.	(5.) At intervals as required.	

SPRAYING CALENDAR—*continued.*

Pest or Disease.	Spray to use.	Time of Application.	Remarks.
	Pip-fruits—continued.		
Apple leaf-hopper.	(3.) Lime-sulphur, 1 in 100, plus 6 lb. precipitated sulphur, or Black Leaf 40, 1 in 800, and soap.	(3.) At intervals when nymph stage is present on trees.	Infection in March is frequently a heavy one, and it is necessary to make at least two sprayings—one within fourteen days of the other—to obtain best results.
Codlin-moth.	(1, 2, and 3.) Arsenate of lead, 3 lb. paste or 1½ lb. powder per 100 gallons, plus milk of lime when intended to be combined with a lime-sulphur spray.	(1.) Petal-fall. (2.) At intervals of from eighteen to twenty-one days up till middle of January. (3.) Continue where necessary in respective localities until all danger of infection is past.	Keep fruit and foliage thoroughly covered with arsenate. Destroy all grub-infected fruit immediately.
Leaf-roller.	(1.) Arsenate of lead, 3 lb. paste or 1½ lb. powder form to 100 gallons. (2.) Arsenate of lead, 4 lb. paste or 2 lb. powder form to 100 gallons.	(1.) Apply at same periods as recommended for codlin-moth control. (2.) Second week in February. (3.) Spray late-maturing varieties again eighteen to twenty-one days later. (4.) Continue where necessary in respective localities until all danger of infection is past.	Add milk of lime to arsenate of lead when it is intended to combine it with a lime-sulphur spray.
Pear-slug ..	Sprayings applied to control codlin-moth are usually sufficient.		
Powdery mildew.	(5.) Precipitated sulphur, 10 lb. to 12 lb. per 100 gallons.	(5.) At intervals of three weeks during early summer months. (6.) Later in season when necessary.	Good results are also obtained from application of lime-sulphur, ¾ gallon to 100 gallons water, plus 8 lb. to 10 lb. precipitated sulphur.

SPRAYING CALENDAR—*continued*.

Pest or Disease.	Spray to use.	Time of Application.	Remarks.
	Pip-fruits—continued.		
Black-spot of apple.	(5.) Lime-sulphur, 1 in 100, plus 8 lb. to 10 lb. precipitated sulphur. Bordeaux, 3–4–50, in localities where black-spot very troublesome, on varieties most susceptible to this disease.	(5.) At intervals as required. In areas where black-spot is prevalent these summer sprays are usually applied at intervals of three weeks.	Sharp lookout should be kept for late spot infection beginning about second week in March. Immediately it is observed control spray should be applied.
Black-spot of pear.	(5.) Bordeaux mixture, 3–4–50	(5.) At intervals as required. In localities where disease is prevalent apply every three weeks.	Advisable to apply lime-sulphur, 1 in 100, to Winter Cole, P. Barry, and Josephine varieties in place of bordeaux.

CULTIVATION AND FERTILIZERS.

In all localities where soil conditions permit cultivation should receive special attention, and every effort should be made to reduce the soil to as fine a tilth as possible. There are but few orchards where cultivation can be dispensed with. An important point which must not be lost sight of is that the season's crop largely depends on the condition in which the soil and the trees are kept during the early summer months.

It is not too late to apply nitrogenous and phosphatic fertilizers, but the application should not be further delayed.

GRAFTING AND BUDDING.

Grafting may still be done, but it is important to remember that to obtain the best results the scions used should be kept dormant.

All stocks successfully worked last season by grafting or budding should be kept well disbudded, and water shoots and suckers should be removed. If stocks on which buds were inserted have not been cut back this should be done at once to encourage a straight trunk.

FRUIT IN STORAGE.

Stored fruit should now be examined once a week. Growers are advised to dispose of their fruit while it is in prime condition and before it shows any sign of shrivelling. In the past much loss has been occasioned because of neglect in this direction. Fruit in poor condition cannot realize good prices, it is hard to sell, and it is unsatisfactory to the consumer.

—*W. K. Dallas, Orchard Instructor, Dunedin.*

CITRUS-CULTURE.

Pruning: When danger from frost is over, the tops of trees which have been damaged may be cut back to good, sound growth. At this time it is usual to find ends of leaders and laterals which have been injured not only by frost but also by brown-rot and excessive wind. All this damaged wood should be removed.

Cultivation: Spring cultivation to a good depth will assist towards forcing the rootlets to a greater depth and ensure a more equitable moisture during summer. Where the land is in rough weeds or cover-crop the plough should be used and the land worked to a fine tilth immediately after. Where the land is reasonably clear and has been winter-ploughed no time should be lost in breaking up the ground to a depth of several inches with a good cultivator.

Spraying: For control of scale and sucking insects oil emulsion, 1–40, should be applied. Bordeaux, 4–4–40, should be applied just prior to the oil where citrus brown-rot has been bad or the trees attacked by other fungi. Further applications of bordeaux at the same formula will be required as the petals fall from the spring blossom, and at intervals later to ensure that all young fruits are covered with spray against verrucosis and grey scab.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

THE YOUNG STOCK.

If all the chickens required this season have not yet been hatched no time should be lost in getting every possible egg put into the incubator or placed under broody hens. There are only a few weeks more for the production of stock which will meet with those favourable conditions necessary to their best development. The drawbacks to late hatching are many, the chief among which being that the chickens have the midsummer heat to contend against, and are then subjected to the cold weather often experienced in the early autumn before they are properly developed.

Poultry-keepers who have to depend on the natural means of incubation and have been handicapped in securing the number of chickens they desire owing to inability to secure broody hens may counteract the drawbacks of late hatching to a certain degree (now that broody hens are more plentiful) by judicious management. The chickens should in every way be encouraged to develop without check. They should be well protected from wind and hot sun. The coop should be frequently moved to fresh ground. Only good, wholesome, grain food should be supplied. Green food is of special importance, and should be fed in abundance. Finely cut succulent grass, lucerne, clover, watercress, lettuce, silver-beet leaves, or even young cabbage-leaves, provide excellent green material for growing chickens. A constant supply of charcoal, grit, and clean water should be kept before the young birds.

There is nothing better for chickens or, indeed, fowls of any age than fresh skim-milk. Where this is available it may be given in good quantities. Care must be taken where milk is provided that the drinking-vessels are kept in a clean, sweet state. It is a mistake to supply sweet milk one day and sour the next, as this is apt to bring on bowel trouble; it should be always sweet or always sour. Personally, the writer prefers it to be sweet at all times where very young chickens are concerned.

If any one requirement should be emphasized more than another it is that of cleanliness and preventing the chickens becoming infested with parasitic life. This implies the frequent removal of droppings and the spraying of the quarters with a reliable disinfectant. It is also important that the mother hen and her brood have access to a good dusting-place in order to free themselves of insect pests.

CHICKEN-COOPS.

A great weakness on many plants is the makeshift appliances which do duty for chicken-coops. This is not to infer that elaborate or expensive coops are necessary. There are few men on the land who cannot make a good-enough coop. Where the worst mistake is made is in failing to construct the coop solidly enough, and in not making it sufficiently draught and rain proof. A box with a sack thrown over it and a few bricks placed on top to keep the sack in place may do well enough in ideal weather, but such a contrivance is only inviting trouble and disappointment when unfavourable weather conditions prevail. Again, much loss is incurred by coops not being cat and rat proof. The makeshift coop generally proves a dear thing in the long-run.

Not only should the coop afford a proper protection for the hen and her brood, but it should also be arranged in such a way that plenty of fresh air is available at all times. It is a common thing for hens with chickens to refuse to go into the coops provided, even when cold, wet weather prevails, unless they are forced to do so. The obvious reason is that the hen knows what is best for her chicks, and rather than take them into an ill-ventilated coop, which is too often infested with red mite, she prefers to remain in the open run notwithstanding the discomfort which she has to endure. The coop should also have a run attached which will effectively protect the young birds during the day from cats and vermin. Losses in chickens from almost any cause are usually put down to bad luck, but in the great majority of cases they are due to bad management.

On no account should chickens be overcrowded. A common mistake made is to dump the chicks hatched from two or more hens with one mother. This is all right in its way when poor hatches are obtained and the number is not excessive, but to put twenty or more chickens with one mother is not sound practice. It is true that the hen may rear the majority of them, or even all, but it cannot be expected that they will make such sound development as if the number had been reduced. It is more profitable to rear a few chickens properly than many indifferently.

SPECIFIC FACTORS AND INQUIRIES.

In the management of poultry of all ages specific factors or local conditions connected with the stock and plant should always be fully taken into account. No rule relating to any branch of the business is capable of universal application. What may prove effective under one set of conditions may fail under another. For example, it is common for the writer to receive requests for advice relative to mortality among brooder chicks, but seldom do the correspondents intimate in any way the particular class or make of brooder that is being used. In such circumstances it is almost impossible to even suggest the cause of the trouble or how preventive methods may be employed.

Colony brooders are a case in point. These are made in various styles, while some are heated with coke and others with oil. In the case of the coke-burners any dampness under the hover (in reason, of course), such as might be expected to come from a concrete or moist earth floor, will in most cases prove beneficial to the chicks. In fact, some breeders who use coke-burning stoves make a practice of spraying water on the earth surrounding the brooder in order to maintain it in a more or less humid state, and with beneficial results. On the other hand, especially with some of the oil-lamp colony brooders on the market, the slightest degree of dampness may cause great losses. It will thus be seen that when lamp brooders are being used dampness surrounding the hover must be avoided at all costs. Even where the brooders are placed on a concrete floor steps should be taken to prevent dampness, or trouble is almost sure to follow. Covering the floor surrounding the brooder with a double thickness of Ruberoid or similar material will often have the desired effect.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

SWARMING.

LEADING authorities are mostly agreed that the instinct for natural increase is the cause of swarming. Many beekeepers attribute swarming to overcrowded brood-chambers, lack of ventilation, and poor queens; but it often happens that swarms issue when none of these conditions is present. On the other hand, bees will refuse to swarm when everything is apparently conducive to their doing so. It must be left to the beekeeper to decide whether he will increase his stock by natural swarming or artificially. If the former plan is adopted it will be wise to allow only strong colonies to swarm. If a weak hive is showing symptoms of swarming—that is, if the bees are building numbers of queen-cells these should be removed and the colony prevented from swarming until such time as it can be requeened. A swarm from a weak hive is not worth encouraging, because it consists simply of a poor queen, probably failing, and a small cluster of bees.

If, however, a strong colony has made up its mind to swarm, the best thing to do is to allow it to throw a prime swarm, and then to most rigorously guard against after-swarming. This can best be done by cutting out all the queen-cells save one after the prime swarm has

issued. Even then it is wise to carefully watch the parent hive for about ten days after the departure of the prime swarm, because there will be eggs in the old hive, and the bees may continue to raise queen-cells.

HIVING SWARMS.

When a swarm issues, if headed by a laying-queen, it will, after circling in the air for a short time, settle probably on some tree or shrub. As soon as the swarm has settled into a cluster, shake all the bees into a box. Place the box on its side, and cover with a clean sack, leaving a small opening for the bees to fly in and out. The swarm may be left alone until late in the afternoon. If by that time it has formed a compact cluster in the box the beekeeper will know that all is well and that it contains a queen. Have the hive in readiness, placed in position where it is to remain. Place a clean sack in front of the entrance, having propped up the front to allow the bees a good space to enter the hive. Dump the bees on the bag as close to the entrance as possible, and very soon they will make their way into the hive. The bag can then be removed and the hive be lowered into position.

In districts where foul-brood is present, or if the beekeeper is suspicious of his own colonies, it is wise to leave the swarm in the box for at least three or four days. At the end of this period place the bees in the hive as described, always choosing the late afternoon for settling them in their permanent home. The object of this practice is to induce the bees to utilize the honey in their sacs to draw down comb, and thus rid themselves of honey from the parent hive ; if it is followed there will be far less trouble from disease, and swarms will invariably start clean.

Unless there is a good honey-flow, or if bad weather sets in, the swarms should be fed inside the hive. This is to give them a good start and to provide them with material for producing wax. Excellent combs can be produced from sugar-syrup. It is advisable in all cases to hive the swarm on full sheets of foundation, and thus take advantage of the natural instinct of the bees to produce wax after swarming. Very little time will be gained if the bees are put on drawn-out combs. In the course of a few days it is advisable to examine the frames to note if the queen is laying and to see if the foundation is being drawn out. When the swarm is placed in the hive one should not forget to put a mat on top of the frames. It often happens that unless precaution is taken to confine the bees they will commence operations in the roof of the hive, more particularly if gable roofs are used.

PREVENTION OF SWARMING.

Frequent examinations of the colonies—every week or ten days during the swarming season—for the purpose of cutting out queen-cells is a help ; but this requires considerable work, and, since it frequently fails in spite of every care, it is not usually relied on.

The occurrence of swarming is largely due to overcrowded brood-chambers ; hence the queen should be given plenty of room to lay. A suitable plan is to give a new brood-chamber comprising two drawn combs and the rest frames of foundation. Secure the queen and confine her in this new chamber below a queen-excluder, placing the old brood-nests directly above, thus giving additional work for the

young bees and plenty of room for the queen to lay in. If for some reason this plan is not desirable the brood may be equalized by robbing the stronger colonies for the benefit of the weaker.

A young queen in the hive is an outstanding factor of success, as bees are rarely inclined to swarm with a young queen if they have reared her themselves under natural conditions. This feature, however, is not always satisfactory to the beekeeper, as he frequently buys young queens in large numbers from a queen-breeder. He still has to contend against the swarming impulse, although in a lesser degree. A beekeeper rearing his own stock should select not only prolific queens to produce from, but those that have previously shown the least tendency to swarm. There are also other reasons why young queens should be employed, and the practice of introducing them in the spring before the swarming season commences, at intervals of not longer than two years, is a very excellent one. Autumn introduction is also commendable, as the full tide of a queen's maturity is gained from the commencement of the following spring. In order to follow the lives of the mothers as closely as possible and to avoid mistakes some system of recording the various ages must be employed. In addition, notes should be taken of their general behaviour, such as tendency to swarm, prolificness, and gentleness. Such notes will prove of great value in selecting a mother of future queens.

Ventilation also plays an important part in controlling the natural inclination to swarm, and care should be taken to provide sufficient air at all times of the season. A well-known and effective method is to place blocks 1 in. in height under the two front corners of the brood-chamber. In the very flush of the honey-flow additional ventilation may be given by drawing one of the supers forward over the rest. This forms two additional entrances and permits the workers to escape to the field without having to traverse the whole depth of the hive.

No single system will be found universally effective. Climatic conditions also frequently play an important part in the behaviour of bees. It will, however, be found that the methods here given, or variations of the same, employed either singly or in combination, will materially assist in the prevention of swarming.

PREVENTION OF AFTER-SWARMING.

In many cases a prime or first swarm is desirable, and in others they often issue in spite of all precautions. It is a simple matter to hive the swarm, but to combat the results in the parent colony arising from this condition entails special action. Persistent after-swarming is one of the discouraging features of natural increase, and is often hard to stop. A good plan is to place the swarm on the old location, removing the parent colony to a new stand some distance away. The immediate result is for all the flying bees to join the swarm, and thus the parent colony is still further weakened. This encourages them to tear down all queen-cells but one, or to destroy all embryo queens after the first young queen has emerged from her cell.

TREATMENT OF SWARMS: PROVISION OF SUPERS.

There is little doubt in the minds of many of the beekeepers who have been accustomed to box hives as to the surplus to be obtained from a swarm. It is not uncommon to find swarms put into frame

hives and not provided with room for surplus. Unless supers are given to strong, early swarms from ten to fifteen days after they are established these colonies will often swarm again, and no surplus will be obtained. It must be understood that the season plays an important part in the returns netted, but large amounts are yearly lost through the beekeeper neglecting to give ample room for the swarm to store honey. When a swarm has been established a few days a hurried examination should be made to note progress, and from this the beekeeper will be able to form some idea as to the time at which the super will be required.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

TOBACCO-GROWING.

"An undertaking that is well commenced is more than half done" is a proverb with special application to the tobacco crop, for the grower who has plants good and early has accomplished the more difficult part of the work of growing a successful crop. However, many dangers lie before the satisfactory accomplishment of his purpose. The seed-beds should be aired gradually in the early parts of the day, in dull, warm weather at first, thus gradually hardening up the plants. While they should by no means be allowed to dry out, it is desirable to keep them rather on the dry side now while the hardening process is taking place. Exposing them to bright sunshine while they are soft and wet will readily burn them; hence the need of carrying out this hardening process with care. If the plants are large enough this operation may be completed towards the end of October, so that they will be ready for planting out in the field as soon as the danger of hard frost is over and the soil is in condition. Keep a sharp lookout for any insect pests or disease among the seedlings and deal with them promptly. Beds of plants that are backward should be kept warm, the hardening process being delayed until they are nearly of a size for planting out.

Meanwhile the preparation of the land in which the crop is to be grown should be completed by light hoeings to destroy seedling weeds and obtain a fine even surface. Avoid deep cultivation at this period, as a firm bed into which the seedlings may be planted will give better results. Some little time before this preparation of the land is completed, broadcast such manures as may be necessary and harrow them in. This application demands careful consideration. In the case of new ground little or nothing may be required; in the case of light land a moderate dressing of superphosphate only will probably meet the requirements. Remember that the kind of leaf required is one of medium size, good quality, and firm texture—not a gross leaf of a soft, sappy nature. On most soils superphosphate and sulphate of potash in reasonable quantities will secure the desired result.

On the day before lifting the plants water the seed-beds well, and, when required, lift the plants carefully with as much of the roots as possible, and place them in trays compactly in an upright position.

The trays may be covered or stood in a shady place until required. In preparation mark off the field in lines 3 ft. apart, and while an assistant places the plants 3 ft. apart along these lines follow him up with a trowel and plant each one firmly and rather on the deep side. In dry weather this operation may require to be completed by watering-in the plants afterwards. While these distances are commonly used, there is a tendency to increase the spacing between the rows and shorten it between the plants in the rows, thus allowing for the more convenient performance of topping and suckering, &c., when the plants are full-grown and the leaves are in danger of being damaged. Avoid planting on bright, hot mornings ; in such weather confine this operation to the latter portion of the day. If the plants are of even size and well selected there will be very few misses; but after a day or two likely failures may be readily detected, and these should be replaced at once.

THE VEGETABLE-GARDEN.

By the time potato and seedling crops are through the ground a thick crop of seedling weeds have usually made their appearance. They are not very obvious at first, perhaps, as compared with the larger growth of the crop. To put the hoes lightly through the rows on the first fine day when the land is dry is an effective and easy way of counteracting what may easily become a costly operation and a serious menace to the success of the crop.

As the warmer weather arrives the more tender crops may be sown Where the winter and spring cabbage and broccolis have been harvested, clean up the ground and prepare it for sowing marrows, pumpkins, cucumbers, and melons, also French and runner beans. As soon as danger of late frosts is past, plant out tomatoes, egg-plants, chili peppers, and kumaras ; but do not be tempted to do this when the ground is wet, even although the day be bright.

In dry, hot localities where summer cabbage is difficult to grow silver-beet may now be sown. In a piece of good ground that has been well prepared and allowed time to settle set out the cauliflower-plants from beds sown a few weeks ago. The main-crop cabbages and cauliflowers that are now established will probably benefit from a dressing of nitrate of soda when the weather is warm. Gardeners should study closely this practice of feeding growing crops with fertilizers ; the adage "Feed the crop and not the land" is a horticultural epigram of the greatest importance.

In a somewhat cool situation sow beds of late celery, Brussels sprouts, and early broccoli for setting out towards the end of the year. At the same time give consideration to the question of allotting them a piece of suitable ground so that it may be in the right condition when available. These crops often follow those of early peas and potatoes.

Asparagus crops will be greatly improved by the occasional application of fertilizers. Destroy thin, useless stalks as soon as they appear.

TOMATOES AND CUCUMBERS UNDER GLASS.

Under glass the tomato crop will be well up the supporting strings and out in blossom. As under these conditions the plants are deprived of the action of winds which shake them and assist in the distribution of pollen, it is customary to assist pollination by the

artificial means of shaking the vines by hand. This is best done about the middle of the day in bright, fine weather. Suppressing lateral growths and training the plants up the strings is the most important work here. This is best done in the early morning with the top ventilators well open. Keep a sharp lookout for any disease or pests that may be about, especially black-stripe. Leave affected plants after marking them, and treat them after the rest of the plants have been attended to, carefully avoiding accidental reinoculation. In warm weather ventilate freely early in the day, but avoid chilling the plants on cold days.

The young growth on cucumbers growing under glass will now require stopping and training. Top-dress the soil with a rich compost from time to time to keep the roots near the surface, and give liquid manure frequently when the plants are cropping.

SMALL-FRUITS.

Gooseberries and currants will benefit from a moderate dressing of nitrate of soda when the fruit has set, while raspberry plantations will derive great benefit from a rather more generous application of the same fertilizer now. Plant out Cape gooseberries in rows 6 ft. apart, running north and south, with 3 ft. between the plants. Warm, light soil in a sheltered position best suits these plants. Hoe strawberry-beds for fruiting to keep them clear of weeds and prevent runners rooting, and have on hand sufficient straw for bedding down the plants as soon as flowering commences. Where this is omitted berries become soiled and gritty during rain-showers, and are thus seriously depreciated.

WEED-DESTRUCTION.

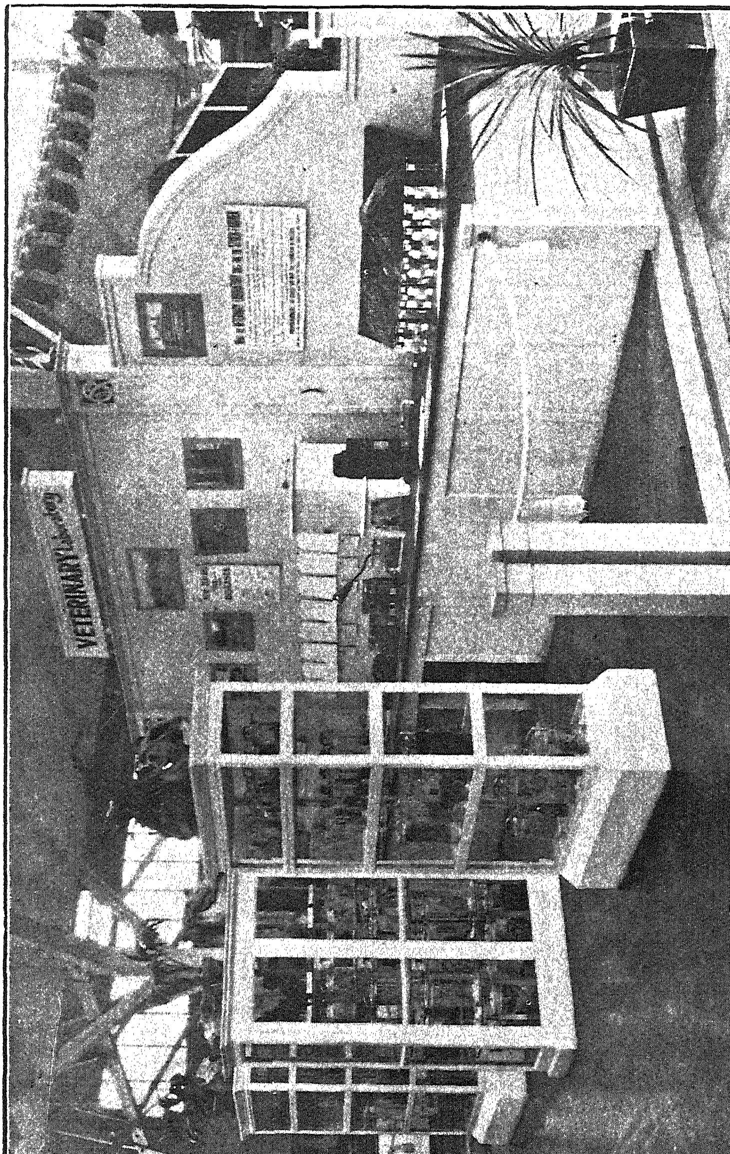
The work of weeding yards and roadways can be reduced to a minimum by the use of the arsenic weed-killer. We are indebted to Mr. A. A. Ramsay for an improvement in this recipe, which is as follows :—

Place 1 lb. arsenic and ¼ lb. caustic soda in a benzine-tin, and mix them well in a dry state. Add water gradually, and mix until the arsenic is dissolved ; then dilute with water up to twenty or even forty gallons, according to the weeds that have to be dealt with. This is best applied in settled weather so as to avoid overdilution by rains following soon after application.

Grass lawns, that should now be looking well, are sometimes disfigured with troublesome weeds. A dressing of sulphate of ammonia (1–2 oz. to the square yard) applied now during dry, settled weather will usually improve the condition of the lawn very considerably.

—*W. C. Hyde, Horticulturist*

Collar-rot of Peas.—Work on the control of collar-rot of peas has been continued at the Biological Laboratory during the past year, and from a laboratory standpoint more or less completed. In the spring of 1925 pea-seed was treated with hot water for field trials, but, unfortunately, weather conditions in Marlborough did not permit the sowing of the seed. Other treatments, including dry dusting of the seed with disinfectants, have been tested on a small experimental scale, and although none of the treatments will control the disease, some increase the vigour of the seedlings probably sufficiently to maintain a healthy plant during the early stages of the disease.



VETERINARY EXHIBIT OF DEPARTMENT OF AGRICULTURE AT NEW ZEALAND AND SOUTH SEAS EXHIBITION, DUNEDIN, 1925–26.

[*Photo by H. Drake.*

WEATHER RECORDS: AUGUST, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

AUGUST, regarded as the last month of winter in New Zealand, was on the whole dull and showery. Reports vary as to temperature and its effects, but the days were generally mild, though frosts occurred frequently at night in many parts of the country.

Rainfall was above the average over the greater part of the North Island and in Otago, but below the mean of former years in the Hawke's Bay and Poverty Bay districts, and in the central part of the South Island on both the east and west coasts, which is rather an unusual occurrence.

An intense westerly disturbance passed in the South on the 5th and 6th, accounting for gales, particularly in the North Island. The most general rainfall, with snow on the higher levels, was reported at this time. Three cyclones passed northward of New Zealand on the 10th, 17th, and 24th, accounting for some heavy downpours in the northern districts. A westerly disturbance at the close of the month brought welcome rains to the Wairarapa and Marlborough districts, and, in spite of frequent showers previously experienced, ended what was regarded as a dry spell.

There was a fair amount of wind, with a prevalence of south-easterlies in the North Island, but conditions were calmer farther south.

RAINFALL FOR AUGUST, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	7·10	17	1·50	5·10
Russell	8·93	17	2·37	6·99
Whangarei	11·67	20	3·65	6·93
Auckland	6·68	27	1·45	4·19
Hamilton	6·72	24	1·80	4·15
Kawhia	6·46	21	0·96	4·60
New Plymouth	7·21	21	1·50	5·29
Riversdale, Inglewood	11·41	24	1·61	8·65
Whangamomona	9·17	16	2·40	5·80
Tairua	9·66	17	2·74	6·98
Tauranga	5·84	19	1·12	4·08
Maraehako Station, Opotiki	7·18	15	2·34	4·75
Gisborne	3·98	18	1·22	4·55
Taupo	4·01	10	1·00	4·23
Napier	3·04	14	0·77	3·57
Maraekakaho Station, Hastings	2·71	17	0·70	3·31
Taihape	4·20	22	0·94	2·73
Masterton	5·39	23	2·21	3·33
Patea	3·51	18	0·54	3·57
Wanganui	2·39	9	0·38	2·78
Foxton	3·59	18	0·66	3·04
Wellington	2·96	21	0·86	4·45
South Island.				
Westport	4·69	19	0·79	6·27
Greymouth	4·90	14	1·00	7·87
Hokitika	6·35	14	1·76	9·34
Ross	10·44	12	3·78	10·40
Arthur's Pass	13·38	6	3·60	13·13
Okuru, Westland	9·00	15	2·92	11·46

RAINFALL FOR AUGUST, 1926—*continued*.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Collingwood	7·50	16	1·21	6·96
Nelson	2·83	12	1·36	3·02
Spring Creek, Blenheim	3·07	14	1·30	2·86
Tophouse	5·36	14	0·85	4·87
Hanmer Springs	1·74	13	0·25	2·56
Highfield, Waiau	1·51	11	0·28	2·28
Gore Bay	1·73	9	0·46	2·28
Christchurch	1·16	15	0·35	1·83
Timaru	0·98	8	0·26	1·41
Lambrook Station, Fairlie	0·46	5	0·22	1·53
Benmore Station, Clearburn	1·92	7	0·60	1·50
Oamaru	1·98	9	0·71	1·71
Queenstown	2·04	7	0·88	1·80
Clyde	0·76	8	0·30	0·80
Dunedin	2·99	17	1·28	3·14
Wendon	2·60	11	0·55	2·08
Gore	2·94	19	0·59	2·34
Invercargill	5·42	24	0·84	3·31
Puysegur Point	..	..	..	7·20

—*D. C. Bates, Director.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 15th July to 26th August, include the following of agricultural interest:—

No. 53526, &c.: Manure and lime distributor; E. C. Houchen, Hamilton. No. 53902: Milking-machine teat-cup claw; Mrs M. B. Judd, Wellington. No. 54582: Milking-machine teat-cup; W. R. Cockburn, Auckland. No. 54667: Fertilizer broadcast sower; C. H. Gower, Marton. No. 55709: Sheep-shear comb; F. G. Bristow, Sydney, N.S.W. No. 55890: Agricultural implement (clod-crushing roller and seed-sower); R. B. Morrow, Brunswick, Vic. No. 56620: Plough; O. E. Nelson, Fernside. No. 56631: Milk cooler and aerator; F. C. Peace, Hamilton. No. 56641: Grain-drying machine; J. A. Hall, Bedford, and W. F. C. George, Northampton, England. No. 53759: Sprayer; E. G. Gresham, Auckland. No. 55045: Motor-tractor attachment: R. G. Macdonald, Bankside. No. 55974: Bee-smoker; E. W. Neumann and J. H. M. Williams, Westport. No. 56432: Harrow; E. Walders, Hamilton. No. 53641: Milking-machine; S. H. Knapp, Greytown. No. 55913: Separator, electrically driven; H. O. Corlett, Te Mawhai. No. 56796: Cheese-treating process; Lakeside Cheese Co., Plymouth, Wis., U.S.A. No. 56810: Flax-washing means; S. H. Maddren, Christchurch.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price 1s.

Actinomycosis.—The number of condemnations for this stock disease throughout the Dominion in 1925–26 was 754, a decrease of 97 on the previous year. Treatment for this disease when detected in the early stages is still the policy of the Live-stock Division in lieu of slaughter, and as a result numerous cases have recovered.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

RINGWORM IN CALVES.

A. ROBERTSON, Tinui :—

Please inform me what is the cause of ringworm on calves, and a remedy for the same.

The Live-stock Division :—

Ringworm is due to a species of fungus growing on the skin, and the following treatment will be found effective in curing it: Wash the affected parts with a solution of washing-soda, and after thoroughly cleansing and scraping apply tincture of iodine over the whole patch. The treatment should be repeated twice further at intervals of five days.

GROWING COCKSFOOT FOR SEED.

A. D., Arundel, South Canterbury :—

We have prepared about 8 acres of land with the intention of putting same down in cocksfoot and keeping it entirely for seed, and should be obliged if you would give us some advice in this connection. As cocksfoot is a slow grower, would you recommend sowing, say, a few pounds of rye-grass with it and grazing it with sheep for the first year ?

The Fields Division :—

We would suggest that you sow either in 21 in. or 14 in. drills, using from 10 lb. to 14 lb. of seed per acre, provided you are prepared to inter-cultivate the crop every winter. Should you consider intercultivation impracticable, sow in 7 in. drills rather than broadcast, and use up to 20 lb. seed, the latter figure being a heavy sowing. The crop being required primarily for seed purposes, we would strongly recommend drills wide enough to allow of intercultivation, and would advise sowing without the addition of any other grass or clover. If sown this spring you should take the first cut of seed in December of next year—that is, fourteen to fifteen months after. The yield of seed and length of life of the stand will depend upon two main factors under your control: (1) Maintaining the fertility by top-dressing, by allowing a certain amount of leafage to decay on the ground, and by intercultivation to keep down weeds and conserve moisture; (2) no stocking, or the very lightest stocking, to avoid the cocksfoot becoming bared to the ground at any time.

PEANUT-GROWING.

J. L. T., Otaki :—

Will you kindly give me instructions for the cultivation of peanuts ?

The Horticulture Division :—

The peanut is a clover-like plant that will not stand frost, but it should do well on suitable land in any climate that will ripen maize. The soil should be a good friable sandy loam. Two bushels of seed in the pod are required to sow an acre. These should be shelled before sowing, carefully avoiding breaking the skin of the kernel in doing so. Some growers merely break the pod in two, but shelling is the better method. The land should be well prepared and weeded from time to time before seeding, which can be done as soon as the danger of a hard frost is past. The usual distance is 3 ft. between the rows and 14 in. between the plants. The crop must be harvested before the first winter frost, as the frost would be injurious to the nuts as well as the vines, which are used for feeding cattle.

CONTROL OF SPURREY.

J. O. H. Tripp, Orari Gorge, Geraldine :—

Would you kindly advise me of the best method of ridding paddocks of spurrey (or yarr) without having to summer fallow ?

The Fields Division :—

Spurrey (*Spergula arvensis*) is an annual free-seeding weed, causing trouble in cultivated paddocks and young grass. Its presence may be taken as a general indication of the need for lime, and the application of 10 cwt. to 15 cwt. of burnt lime per acre may materially modify the conditions under which it flourishes. Sheep will eat spurrey with relish, and this affords a means of control, by sufficiently heavy stocking to prevent seeding. It is recorded that spraying with a 4-per-cent. solution of copper sulphate, using 100 gallons per acre, is partially effective in killing spurrey, and of no detriment to the land or crops growing thereon. Where a fallow can be carried out the ground should be worked down as fine as possible in the spring, and the most favourable conditions brought about to assist the spurrey-seed to germinate. Thereafter, repeated harrowings as soon as the weed shows up will very largely assist in eradication. This spring and summer fallow should extend as long as possible, and be followed by sowing green feed such as oats and vetches, followed by heavy stocking.

INFECTION FROM CONTAGIOUS ABORTION.

"Anxious," Masterton :—

Kindly inform me how long it is necessary to keep dairy cows out of a paddock where a heifer suffering from contagious abortion has been grazing. The heifer aborted about a month ago, and ever since then has shown a slight discharge.

The Live-stock Division :—

The best course would be to keep the paddock clear of dairy cows for six months after the discharge from the heifer has ceased. It is advisable to destroy all membranes and the dead fœtus directly after parturition, and to continue washing the cow out until the discharge has stopped. Six months would give ample time for the infection to die. You would probably find it impracticable to leave the paddock empty for this time, and sheep, or any dry stock not intended for breeding from, might therefore be turned on to the land with advantage. Close eating of the grass or cultivation reduces the risk of infection considerably.

BIRDS AND GRASS-SEED.

"Subscriber," Waipu :—

I intend broadcasting grass-seed on old hill pasture this spring. Would you please advise of any treatment of seed to combat the small-bird nuisance?

The Fields Division :—

It is extremely difficult to prevent small birds from eating grass-seed. A treatment that has been found successful is as follows : Mix turpentine and kerosene in the proportion of 1 pint of turpentine to 1 gallon of kerosene. When sowing, tip about ½ bushel of seed into the sowing-bag, then pour ½ pint or a little more of the mixture over the seed, stirring the latter well at the same time. The seed will not get sticky unless too much of the mixture is used.

Rimless Cheese.—The Dairy Division reports that in the 1925–26 season the finish of cheese showed a considerable improvement, and a fair number of dairy companies were turning out a rimless cheese. This was particularly noticeable in the Auckland District, where about 95 per cent. of the factories used the rimless hoop.

LEGISLATION AFFECTING AGRICULTURE.

DURING the session of Parliament concluded on 11th September the following Acts directly relating to agriculture or of general rural bearing were passed: Dairy Industry Amendment, Veterinary Surgeons, New Zealand Agricultural College, Dairy-produce Export Control Amendment, Rural Advances, Bank of New Zealand (long-term rural mortgages), Land Laws Amendment, Swamp Drainage Amendment, Howard Estate Amendment. The Scientific and Industrial Research Act may also be recorded. The following Bills were introduced but dropped for the time being: Noxious Weeds Amendment, Stock Amendment.

BOARD OF AGRICULTURE APPOINTMENTS.

THE appointment of the following as members of the Board of Agriculture for the triennial period ending 30th April, 1929, was gazetted on 2nd September: Sir J. G. Wilson, Messrs. E. Hall, W. Perry, and G. L. Marshall (Government nominees), D. W. Westenra (Canterbury), W. W. Massey (Auckland), D. Marshall (Southland), J. Begg (Otago), J. H. Absolom (Hawke's Bay), W. B. Grant (Taranaki), Q. Donald (Wellington-Wairarapa), and W. D. Pike (Marlborough, Nelson, and Westland). Sir J. G. Wilson has been named as President of the Board.

FORTHCOMING AGRICULTURAL SHOWS.

Hawke's Bay A. and P. Society: Hastings, 20th and 21st October, 1926.
Poverty Bay A. and P. Association: Gisborne, 26th and 27th October.
Marlborough A. and P. Association: Blenheim, 27th and 28th October.
Wairarapa A. and P. Society: Carterton, 27th and 28th October.
Timaru A. and P. Association: Timaru, 27th and 28th October.
Manawatu A. and P. Association: Palmerston North, 2nd, 3rd, and 4th November.
Waikato A. and P. Association: Hamilton, 3rd and 4th November.
Ashburton A. and P. Association: Ashburton, 4th November.
Wanganui A. and P. Association: Wanganui, 10th and 11th November.
Canterbury A. and P. Association: Christchurch, 11th and 12th November.
Auckland A. and P. Society: Royal Show, Auckland, 16th and 18th November.
Wallace A. and P. Association: Otautau, 17th November.
North Otago A. and P. Association: Oamaru, 17th and 18th November.
Otago A. and P. Society: Dunedin, 24th and 25th November.
Egmont A. and P. Association: Hawera, 24th and 25th November.
Whangarei A. and P. Society: Whangarei, 24th and 25th November.
Stratford A. and P. Association: Stratford, 1st and 2nd December.
Wyndham A. and P. Society: Wyndham, 10th December.
Horowhenua A. and P. Association: Levin, 25th and 26th January, 1927.
Golden Bay A. and P. Association: Motupipi, 1st February.
Feilding A. and P. Association: Feilding, 1st and 2nd February.
Dannevirke A. and P. Association: Dannevirke, 9th, 10th, and 11th February.
Te Puke A. and P. Association: Te Puke, 9th February.
Pahiatua A. and P. Association: Pahiatua, 12th February.
Rodney Agricultural Society: Warkworth, 12th February.
Masterton A. and P. Association; Solway, 15th and 16th February.
Buller A. and P. Association: Westport, 18th and 19th February.
Marton A. and P. Association: Marton, 23rd February.
Franklin A. and P. Association: Pukekohe, 25th and 26th February.
Waikato Central Agricultural Association: Cambridge, 2nd and 3rd March.
Morrinsville A., P., and H. Society: Morrinsville, 9th March.
Amuri A. and P. Association: Waiau, 9th March.
Taranaki Metropolitan Agricultural Society: New Plymouth, 9th March.
Mayfield A. and P. Association: Mayfield, 19th March.
Temuka A. and P. Association: Geraldine, 7th April.

Association secretaries are invited to supply dates and location of their shows for publication in this list.

The New Zealand
Journal of Agriculture.

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DAIRY-HERD TESTING IN NEW ZEALAND.

REVIEW OF 1925–26 SEASON.

W. M. SINGLETON, Director of the Dairy Division, and W. N. PATON.

INTRODUCTION.

FOR the season of 1925–26 dairy-herd testing in the Dominion has shown a decrease in the number of cows under test as compared with the preceding season, when the greatest number in the history of the movement in this country since its inception in 1909 was recorded. On the basis of all cows under herd-test which were tested two or more times the 1925–26 figures stand at 169,776, as against 196,850 for the preceding season, representing 13·0 per cent. and 14·9 per cent. respectively of the Dominion's total of all dairy cows in milk and dry for the years specified. The decrease amounts to 27,074 cows, or 13·8 per cent. on the number of cows under test for the 1924–25 season.

This decrease, although considerable, must not be viewed with serious misgivings. Herd-testing in New Zealand since the close of the Great War has been increasing very rapidly year by year, and it would seem that a stage has now been reached when a steadying-up in the progress of the movement is likely to be evidenced. Viewed in the light of the progress of herd-testing in certain countries where the movement commenced at earlier dates, it would appear that we are only experiencing a similar temporary decrease to those experienced by the others. Moreover, the total of dairy cows in milk and dry in the Dominion has decreased from 31st January, 1925, to 31st January, 1926, to the extent of 19,576, or about 1·5 per cent. This must have had some influence on the position, and in conjunction with the rather unsatisfactory dairying season experienced in 1925–26 may account for much of the decrease. However, group herd-testing shows an increase of 5,172 cows, the totals being 105,227 for 1925–26 and 100,055 for 1924–25. Furthermore, the number of cows under test in the Southland Land District has risen from 3,393 in 1924–25 to 8,220 in 1925–26, or 142 per cent.

It is gratifying to record such an increase as this, but, although the work has been taken up in many other new districts also, the

position is offset by the fact that herd-testing has fallen off in some of the older testing districts, with the result that all the principal land districts concerned show decreases. One factor which has operated in this direction is doubtless the tendency on the part of a number of dairy-farmers to test their cows for one season, and not to trouble retesting any whose yields are considered satisfactory in comparison with the yield of the average cow in the herd. Such dairymen often rejoin the association or group after a couple of years or so, and as, in their opinion, the reconstitution of the herd makes it necessary. Other dairy-farmers, after testing the herd for a season and culling out their lowest producers, test the following season only those individuals still considered doubtful, or which have been brought in as heifers, or as cows purchased in order to maintain the numerical strength of the herd.

If a dairy-farmer cannot see his way to test his whole herd each season, the testing of all females added to the herd should certainly be undertaken. This not only keeps the owner more up to date with respect to data regarding the producing-capacity of the individuals in his herd, but it also assists materially in ensuring the continuity of the association year by year. It cannot be gainsaid that a herd-testing association is an asset to a district, and that a district sustains a distinct loss when its association or group lapses through insufficient support.

In view of the irregularity in testing referred to, the total number of cows under test in any one season, therefore, cannot be taken as a correct index of the number of tested cows in the Dominion's dairy herds.

COLLECTION OF DATA.

Ever since the inception of dairy-herd testing in the Dominion the Department has been collecting data in regard to the number of all cows under test each year, and seasonal production figures for only those associations controlled by officers of the Dairy Division. It was not until four years ago that the collection of seasonal production data from all herd-testing organizations operating throughout the Dominion was undertaken. The Dairy Instructors for the various districts report to the head office of the Dairy Division what herd-testing bodies, &c., are operating in their respective districts, together with the number of cows under test. This return, in addition to correspondence on file with various existing and intending associations, provides a list which, although it may not be absolutely complete, is as nearly so as possible. No account is taken of cases where dairymen are doing their own testing, as the collection of information on these lines is not very feasible. Since, however, many dairy-farmers have their own testing appliances, quite a lot of this work must be going on.

With the aid of this list all herd-testing bodies are circularized each year with a request to supply a seasonal production summary for all tested cows in milk 100 days or over since calving, but not exceeding 365 days, and to confirm the number of cows tested twice or more. Needless to say, the work is attended with many difficulties, but through the co-operation of the various testing bodies fairly complete information on a uniform basis has been collected each year. We

would like to here record our appreciation of the ready manner in which our requests have been met, and to thank all those who have supplied annual summaries of results.

SYSTEMS OF TESTING IN OPERATION.

As outlined in some detail in last year's review (*Journal* for October, 1925), dairy-herd testing in New Zealand is conducted under practically three distinct systems—namely, "Association," "Group," and "Dairy Company." Under the Association system members do their own weighing and sampling of their cows for two days (in a few cases one day) out of every thirty days, while in the case of the Group system weighing and sampling of cows is done by a testing officer for one day every month. In both cases samples are tested by testing officers, returns figured, and sheets returned to the dairy-farmers. Testing under the Dairy Company system follows the Association method, except that the figuring of returns is left to the herd-owners themselves.

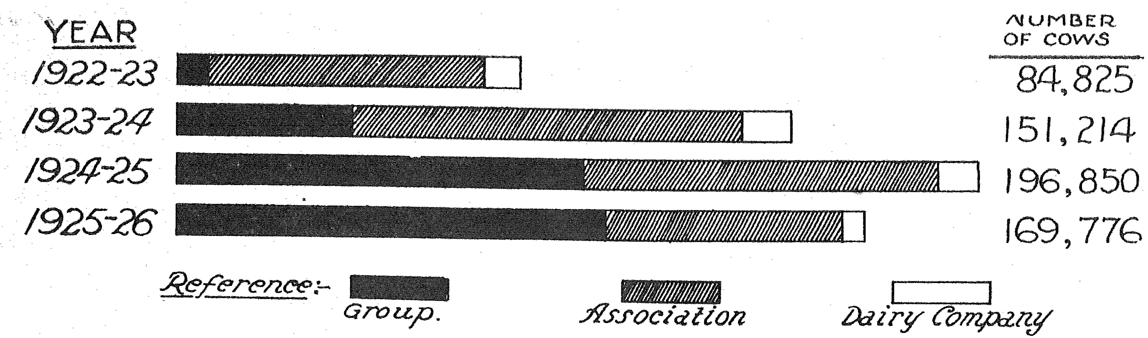
EXTENT OF TESTING.

The number of cows tested twice or more for the past four seasons, grouped according to the three systems of testing in operation as described in the preceding paragraph, is given in Table 1. Together with the table, a graph covering the same period is shown, which should give a better idea of the relative extent of herd-testing not only as a whole, but also according to system. As previously stated, a decrease in the number of cows under test for the 1925–26 season has occurred. It will be noticed that the decrease is manifested in those portions of the testing-work operating under the Association and Dairy Company systems. In fact, the decreases in the number of cows under test for these two systems date back for the past two seasons. Group herd-testing, however, shows a moderate increase for the year, more than maintaining its former position in spite of the factors which have produced a decrease in the total volume of testing. The Association system, although it has decreased as far as total and average number of cows tested is concerned, has actually increased in the number of associations, the 1925–26 total being the highest to date. The number of groups has decreased, but is more than counterbalanced by the increase in the average number of cows per group. It would appear from the points revealed, and other information, that the Group system is replacing the Association system to some extent in the more intensive dairying districts, while the Association system is finding favour in the less specialized dairying areas.

In order to follow the trend of herd-testing by districts for the past four seasons Table 2 has been prepared. The districts correspond with the land districts, as used by the Government Statistician in classifying agricultural and pastoral statistics. For this reason the division is a more useful one than if done according to provinces. For reference the boundaries of the various land districts as used in this classification are shown in the accompanying map featuring the distribution oi herd-testing. It will be noticed that the South Island figures have been subdivided this year. This has been done mainly for the reason that the amount of herd-testing in Southland has now

Table 1.—Numbers of Cows tested Twice or more, classified according to Season and System of Testing.

System.	1922–23.			1923–24.			1924–25.			1925–26.		
	Number of Associations, &c.	Number of Cows.	Average Cows per Association, &c.	Number of Associations, &c.	Number of Cows.	Average Cows per Association, &c.	Number of Associations, &c.	Number of Cows.	Average Cows per Association, &c.	Number of Associations, &c.	Number of Cows.	Average Cows per Association, &c.
Association ..	90	67,835	754	114	96,198	844	117	87,695	750	124	59,345	479
Group ..	6	7,500	1,250	34	43,144	1,269	91	100,055	1,100	86	105,227	1,224
Dairy Company	46	9,490	206	42	11,872	283	51	9,100	178	38	5,204	137
All ..	142	84,825	597	190	151,214	796	259	196,850	760	248	169,776	685



GRAPH SHOWING THE EXTENT OF HERD-TESTING IN NEW ZEALAND FOR LAST FOUR YEARS—AS A WHOLE AND ACCORDING TO SYSTEM.

Table 2.—Number of Cows tested Twice or more, classified according to Season and Land District, &c.

Land District, &c.	1922–23.		1923–24.		1924–1925.		1925–26.	
	Cows tested Twice or more.	Percentage of Total Cows in Milk.†	Cows tested Twice or more.	Percentage of Total Cows in Milk.†	Cows tested Twice or more.	Percentage of Total Cows in Milk.†	Cows tested Twice or more.	Percentage of Total Cows in Milk.†
North Auckland ..	17,973	10·9	23,521	13·4	31,049	17·7	24,951	13·9
Auckland	32,123	12·1	63,945	22·1	93,912	32·5	77,651	25·1
Gisborne	2,419	10·2	3,122	11·9	4,022	14·9	3,891	14·5
Hawke's Bay	1,629	3·7	4,391	9·4	5,468	11·2	4,902	10·6
Taranaki	15,585	8·3	18,567	9·7	16,840	8·7	16,485	8·5
Wellington	12,962*	7·4	30,584	16·6	37,415	20·2	29,653	16·4
North Island ..	82,691*	9·6	144,130	15·8	188,706	20·7	157,533	16·8
Nelson	..	..	1,192	4·7	574	2·2	880	3·4
Marlborough	105	0·7	175	1·1	147	0·9	441	2·8
Westland	..	..	771	7·0	..	..	..	..
Canterbury	1,400	1·6	2,345	2·7	2,171	2·6	1,799	2·4
Otago	499	0·9	2,416	4·3	1,859	3·5	903	1·8
Southland	130	0·2	185	0·2	3,393	4·8	8,220	12·5
South Island ..	2,134*	0·8	7,084	2·6	8,144	3·1	12,243	5·0
Dominion	84,825	7·5	151,214	12 8	196,850	16·5	169,776	14·4

* Amended returns. † As at 31st January.

reached proportions worthy of individual comparison with the various North Island land districts. In fact, as mentioned in the introduction, Southland is the only district showing an increase for the past season.

As in our last review, the percentages quoted are on the basis of all cows in milk only, and as at 31st January of the respective years. This appears to be a preferable basis to that of all dairy cows in milk and dry as at the respective periods, since cows dry at this time of the year are mcre than likely not available for testing, as they would in all probability have been too long in milk at the usual date of commencement for the herd-testing season. For the 1925–26 season it will be observed that in the North Island one cow in every six was tested, while in the South Island only one in every twenty was so accounted for. For the Dominion one cow in every seven was tested in 1925–26, whereas the corresponding 1924–25 figures showed one in six.

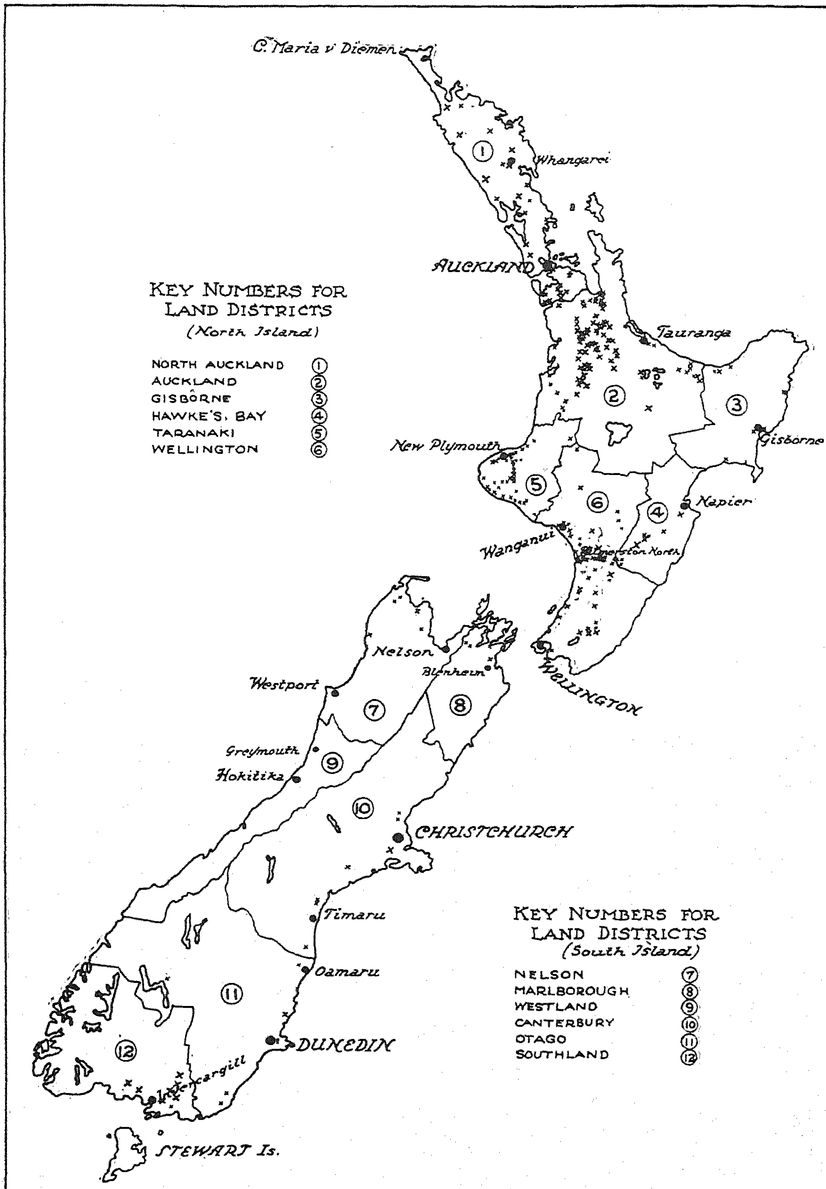
DISTRIBUTION OF TESTING.

For the purpose of added interest this year a map of New Zealand has been prepared showing by means of crosses the approximate location of herd-testing centres throughout the Dominion. By this means an indication of the distribution of herd-testing is provided. As would be expected, the areas covered correspond chiefly with the more intensive dairying districts. Boundaries of land districts are also shown, and this information, studied in conjunction with that contained in Table 2, should prove a useful supplement.

AVERAGE YIELD OF TESTED COWS.

Much useful information may be gleaned from annual summaries prepared from continued seasonal butterfat records, and the necessity for this work to be undertaken by each herd-testing body must be stressed. Quite apart from the value of these summaries when collected and reviewed, the information so obtained should prove of interest to the individual members of the respective herd-testing associations.

As mentioned earlier, in the paragraph "Collection of Data," production summaries have been collected by the Dairy Division for the past four seasons, and in regard to the 1925–26 season have been collected from practically every one of the associations and groups operating throughout the Dominion. Seeing that members are left to do their own figuring in the case of the Dairy Company system, summaries of these are not available. Their collection would mean obtaining a return from each member, and this would not be feasible. In only a few cases were the summaries received incomplete to such extent that they could not be utilized in our grand summary. Effective summaries received for the 1925–26 season represent 96·5 per cent. of the total number of cows tested twice or more for all groups and associations. Corresponding percentages for 1924–25 and 1923–24 are 91 and 92 respectively. The production summaries, as already indicated, are requested on the basis of all cows in milk 100 days or over, and the number of cows so represented in the effective summaries received for the past season total 146,398, as against 151,875 for the preceding season. Notwithstanding a decrease of 27,074 cows in the total cows



MAP SHOWING THE DISTRIBUTION OF HERD-TESTING IN NEW ZEALAND, SEASON 1925–26.

Each unit or section is shown by a cross. Boundaries of land districts are also shown.

tested twice or more, the decrease in the numbers as included in the grand summaries is only 5,477 cows. This is due to the fact that a higher percentage of satisfactory summaries was obtained this year than last.

Table 3 gives the numbers of cows, herds, and associations, and average size of herds and associations, represented in all effective annual summaries (on the 100-days-or-more basis) received for the past three seasons. "Association" as used in this table refers to all herd-testing sections, and includes those operated under the Group as well as under the Association system. There is, unfortunately, a confliction in herd-testing nomenclature, inasmuch as sections operating under either the Group or Association systems are termed "herd-testing associations," or, more briefly, "associations."

Table 3.—Numbers of Cows, Herds, and Associations represented in Effective Seasons' Summaries received. (Basis: All Cows in Milk 100 Days or over.)*

—	1923–24.	1924–25.	1925–26.
Number of associations	140	190	201
Number of herds	3,837	4,815	4,458
Number of cows	107,777	151,875	146,398
Average number of herds per association..	27	25	22
Average number of cows per herd ..	28	32	33
Average number of cows per association	770	799	728

* Including both Group and Association systems, and on basis of sections or units.

Table 4 presents information similar to that in the lower half of Table 3, except that the material has been separated according to the system adopted.

Table 4.—Average Size of Associations and Groups for which Effective Seasons' Summaries on the Basis of all Cows in Milk 100 Days or over were received.

System.	Season.	Average Number of Herds per Association or Group.	Average Number of Cows per Association or Group.	Average Number of Cows per Herd.
Association ..	1923–24	28	641	23
	1924–25	25	574	23
	1925–26	19	407	22
Group ..	1923–24	25	1,203	48
	1924–25	26	1,185	45
	1925–26	27	1,205	44

Table 5 represents grand summaries of results for the past two seasons. The average production shown in similar tables for the 1923–24 and 1922–23 seasons was 213·01 lb. butterfat in 230 days and 233·71 lb. in 225 days respectively. The past season's figures show a decrease of about 3 lb. of butterfat, which must be considered satisfactory in view of the fact that the 1925–26 season was not as favourable as 1924–25.

Table 5.—Grand Summary of all Effective Herd-testing Results on the Basis of all Cows in Milk 100 Days or over received for the Last Two Seasons.

—	1924–25.		1925–26.	
	Days in Milk.	Pounds of Butterfat.	Days in Milk.	Pounds of Butterfat.
Average for all cows (151,875 in 1924–25 and 146,398 in 1925–26)	229	223·54	230	220·51
Highest Association or Group average ..	259	319·78	263	323·24
Lowest Association or Group average ..	169	154·13	168	153·14
Highest herd average	308	442·25	233	500·21
Lowest herd average	130	38·78	125	51·69
Highest cow	365	870·07	286	819·85
Lowest cow	223	28·61	120	11·13
Average daily production of butterfat for all cows	..	0·98	..	0·96

Table 6 supplies a comparison of average production according to system of operation. Earlier in this article, when considering the numbers of cows tested under the two main systems, the idea was expressed that the Association system was going out in some of the more intensive dairying districts where groups were now operating, and was finding favour in the more outlying districts. The result of this is evidenced in Table 6, since on the one hand the Association system average has decreased considerably, while on the other hand the Group average has increased just a little notwithstanding the unfavourable season. It need not be emphasized that dairy cows in the more intensive dairying districts are, on the average, considerably more productive than those in the outlying districts. There are two main reasons for this—quality of stock and land—and both operate in the one direction.

Table 6.—Average Production of all Effective Results for Past Two Seasons classified according to System. (Basis: All Cows in Milk 100 Days or over.)

Year.	System.	Number of Associations or Groups.	Number of Herds.	Number of Cows.	Average Days in Milk.	Average Butterfat.
						lb.
1924–25 ..	Association	120	2,968	68,914	221	224·75
	Group ..	70	1,847	82,961	235	222·54
1925–26 ..	Association	120	2,239	48,823	217	215·40
	Group ..	81	2,219	97,575	236	223·06

As pointed out in last year's review, comparison of average production year by year is difficult, and deductions are to be made with the greatest care and only after the data have been viewed from all angles. Associations as well as individual herds drop out or come in for the first time from year to year, and unless comparison of results is made for the same herds only in each case, and due allowance made for variation in nature of the seasons, increase or decrease in production cannot be properly shown. Even when such comparisons are prepared,

the problem of just how much to allow for difference in nature of seasons is one which is difficult of satisfactory settlement.

It will be noticed, moreover, that a difference exists in the average length of time cows are under test in the case of the two systems of testing—Group and Association. Reference to Table 6 will make this readily apparent; but now that the Association system is tending more towards the sparser dairying districts than formerly this difference is likely to increase, since cows in these districts are, on the average, of a poorer type, and, moreover, are generally kept on poorer land. This difference manifests itself even where a group and an association are operating side by side, and is due to the fact that under the Association system some dairy-farmers, after weighing and sampling for a fair number of months, cease a little sooner than do most groups, because of the time taken up in this work being considered of more value than further periods of testing at a time when cows are producing at a low rate and further testing is unlikely to alter the order of the individual records to any appreciable extent, despite the fact that some cows on long-time test show up to better advantage than on shorter periods. This difference in the average length of time over which associations and groups operate during a season affects the grand summary of results, for the reason that different proportions of results obtained under the two systems are included each year. Due allowance, therefore, has to be made for this fact in comparing one year's grand summary with that of another.

The Dairy Division has, in regard to those associations which are tested by its officers, made a practice of compiling production summaries on the basis of all cows in milk 210 days or over, as well as on the basis of 100 days or over. This type of summary has certain advantages, inasmuch as it provides an indication of production over a period more consistent with that of the length of a dairying season. The 100-days-or-more summary has the advantage that it includes records for some cows of such poor quality that their lactation periods fall short of 210 days. It has the disadvantage, however, of including records of cows that have died, fallen sick, been sold, or discontinued considerably before their testing would have been completed. Table 7 supplies a comparison of results on the two bases, and has been compiled from all data for the past four seasons resulting from association testing-work conducted by the Division's officers.

Table 7.—Average Production for Associations conducted by Officers of the Dairy Division, comparing Difference in Production between Results of Summaries compiled on the Basis of all Cows in Milk 100 Days or more and 210 Days or more.

Year.	100 Days or more.		210 Days or more.	
	Average Days.	Average Butterfat.	Average Days.	Average Butterfat.
		lb.		lb.
1922–23	227	232·99	261	271·48
1923–24	227	221·39	258	267·10
1924–25	223	231·51	258	266·29
1925–26	218	221·19	257	259·20

About 65 per cent. of the records appearing in the 100-days-or-over summary are for periods of 210 days or over, and together constitute the respective averages as shown under the 210-days heading. In other words, 35 per cent. of the records in the 100-day column are for periods between the limits of 100 and 210 days. It must not be accepted, therefore, that the differences in production under the two bases represent the amount of butterfat produced in the number of days represented by differences in average days in milk. It may be assumed, however, that, for records compiled under the Association system, 100-days-or-over and 210-days-or-over summaries will bear out similar differences as evidenced in this table, and the proportions represented may be safely utilized for the purposes of obtaining, from 100-days-or-over figures available, estimates on a 210-days-or-over basis. The proportions, however, would not hold true as well in the case of groups. Here the percentage of cows in a 100-days-or-more summary, whose records lie between 100 and 210 days, would be considerably less than in the case of the Association system.

In order to compare average production for the past three years by land districts Table 8 is presented. As in the case of Table 2, the figures for Southland are now worthy of being shown separately, and the other South Island districts have been brought into line also, although the percentages of the total cows in milk represented in these averages are too low to be significant, and therefore should not be used to any extent for comparative purposes. All the North Island districts and Southland are represented by fairly significant percentages, and the respective averages may be considered to represent roughly the relative difference in production for all dairy cows in these districts. Of course, allowance must be made for appreciable differences in the percentage of all dairy cows so represented in each case. It would not be absolutely correct to say that Auckland, with 23·7 per cent. of that land district's total dairy cows in milk represented in the figures shown for 1925–26, is about 16 lb. of butterfat, or 6·5 per cent., lower in average production than Taranaki, since the Taranaki figures are for only about a quarter of Auckland's percentage. The figures for Auckland must include a greater percentage of the poorer dairy cows of that district than in the case of Taranaki, since herd-testing is first of all taken up by the more progressive dairymen, and these usually own better-quality herds. As the movement progresses more and more it would be fairly safe to assume that new herds joining up represent, on the average, poorer and poorer quality herds at each stage. Provided the testing in the various districts is not confined to principally one locality, the averages in this table should be representative samples of the dairy cows in the respective districts. From the map showing distribution of testing, however, it will be observed that all the North Island land districts and Southland are well represented.

All averages shown in the table are undoubtedly on the high side as representing average production for all dairy cows. The remaining herds in each case represent, on the average, herds of poorer quality. Some of these herds will have been tested previously, but the larger proportion will not have been tested at all, and will, in the majority of cases, be of a lower producing standard. It is considered, however, that relatively the comparison will be fairly correct for those land

Table 8.—Average Production, according to Land Districts, &c., of all Cows under Herd-test for which Effective Seasons' Summaries were obtained. (Basis: All Cows in Milk 100 Days or over.)

Land District, &c.	1923–24.				1924–25.				1925–26.			
	Average Days.	Average Butterfat.	Cows in Summary.	Percentage of Total Cows in Milk.*	Average Days.	Average Butterfat.	Cows in Summary.	Percentage of Total Cows in Milk.*	Average Days.	Average Butterfat.	Cows in Summary.	Percentage of Total Cows in Milk.*
		lb.				lb.				lb.		
North Auckland ..	219	200·23	16,270	9·3	216	205·14	25,685	14·3	224	210·94	20,925	11·6
Auckland	234	207·86	48,253	16·7	235	224·98	77,003	25·7	236	226·08	73,101	23·7
Gisborne	209	202·16	2,026	7·7	204	208·34	3,455	12·8	212	191·03	3,368	12·5
Hawke's Bay	231	228·34	1,790	3·8	243	233·25	4,575	9·4	224	189·32	4,294	9·2
Taranaki	233	246·66	13,377	7·0	233	251·58	11,683	6·0	235	242·42	12,840	6·6
Wellington	237	215·60	22,402	12·1	228	230·99	24,199	13·0	223	212·64	22,043	12·2
North Island ..	232	213·56	104,118	11·4	230	224·48	146,600	15·7	231	221·11	136,577	14·6
Nelson	195	204·93	235	0·9	258	283·16	104	0·4	192	207·16	609	2·4
Marlborough	..	..	..	..	..	..	..	..	..	..	..	..
Westland	..	..	..	..	..	..	..	..	..	..	..	..
Canterbury	191	199·76	1,483	1·7	196	213·15	909	1·1	195	217·21	391	0·5
Otago	196	193·73	1,819	3·2	204	203·04	1,249	2·3	218	223·60	804	1·6
Southland	204	210·91	122	0·2	191	187·28	3,013	4·2	217	211·14	8,017	12·2
South Island ..	194	197·47	3,659	1·3	197	197·36	5,275	2·0	214	212·15	9,821	4·0
Dominion	230	213·01	107,777	9·1	229	223·54	151,875	12·7	230	220·51	146,398	12·4

* As at 31st January.

districts particularly mentioned. A rough indication of the average production of all cows in each case will be given by taking about four-fifths of the average butterfat figures shown in Table 8. Hawke's Bay shows a big drop in average production for the past season, and this only goes to show how unfavourable the season was in this case. Wellington, Taranaki, and Gisborne show considerable decreases also, while the average production for all tested cows in North Auckland, Auckland, and Southland has increased. The increase for Southland is probably not very significant, for the reason that the majority of the results for 1925–26 are from intensive dairying localities, whereas formerly these parts were represented proportionately to a much lesser extent. The advent of Group herd-testing has had an effect on the average production figures for other land districts also. However, the inclusion of Group herd-testing figures may influence results otherwise than in the case of Southland. For instance, the average production for Hawke's Bay in 1924–25 for the same associations as the previous year would have been 243 lb. of butterfat instead of 233 lb., Group testing results being included that year for the first time. Taranaki includes results for three groups in 1925–26, whereas formerly herd-testing was conducted entirely under the Association and Dairy Company systems. Auckland, North Auckland, and Wellington, however, have Group figures included for each of the three seasons shown in the table, and in the case of Gisborne for the past two seasons.

Table 9.—Percentages of Dry Cows to Total Numbers of Dairy Cows in Milk and Dry for Past Four Seasons in Chief Land Districts concerned.

Land District, &c.	31st January, 1923.	31st January, 1924.	31st January, 1925.	31st January 1926.
North Auckland ..	11·2	11·3	11·9	10·6
Auckland	9·0	8·0	7·4	6·8
Gisborne	12·6	15·0	14·9	16·4
Hawke's Bay	13·2	13·6	14·1	15·2
Taranaki	6·9	5·6	5·2	5·4
Wellington	9·5	9·9	9·6	10·3
North Island ..	9·4	9·1	8·9	8·7
Southland	8·4	8·5	10·3	10·1
South Island ..	11·5	11·9	12·2	11·9
Dominion	9·9	9·7	9·7	9·4

An interesting point in regard to the order of height of average production in the chief land districts concerned is shown in Table 9. The figures are self-explanatory, and may be taken as an index of the improvement effected in dairy herds in the various districts by culling, &c. The order of percentages in this table will be seen to closely follow the order of average production for tested cows shown in Table 8, in particular for the 1925–26 season. Taranaki and Auckland appear to be the only two districts which have been doing very effective work in eliminating unproductive dairy cows during the past few seasons.

(To be continued.)

LIVER-FLUKE IN SHEEP AND ITS CONTROL.

E. E. ELPHICK, M.R.C.V.S., Departmental Veterinarian, Hastings.

FOR a number of years past the mortality among sheep due to fluke infection in certain districts of the Dominion has been appreciable. The areas on which "flukey" sheep may be found have certainly extended, and will continue to extend if steps are not taken to control the parasite. Fortunately, a number of farmers are now realizing that the trouble can be curtailed, and are taking steps to bring about the desired effect. The results of their endeavours will be watched with interest, and their success should be a lesson to neighbours who are in many cases willing to let things take their own course.

As showing the seriousness which fluke disease may attain it is recorded that in 1910, in certain parts of France, the mortality among sheep from this cause reached 40 to 50 per cent. of the flocks. This was attributed to the wet season which characterized the end of that year.

LIFE-HISTORY.

The fluke is found in the bile canals and ducts of the liver. It may be found in other parts of the body, but its presence here is probably accidental. It is a flattened, flounder-shaped parasite up to about 1 in. in length, varying according to its age and sexual maturity. The life-history is a very complicated one, but a short account of it is necessary if control of the trouble is to be understood.

The eggs of the sexually mature fluke pass out in the animal's dung, and if passed on a swampy area or into water a ciliated embryo is hatched out. This embryo finds a species of fresh-water snail, and, after boring into it, develops a form knows as a cercaria. This resembles a very small fluke, but it has a tail which aids it to move about. This tail is lost, the cercaria encysts, and this encysted form attaches itself to a grass-blade or other vegetation which may be suitable. In a season like the one lately experienced on the East Coast the sheep do not stay on the dry hills, but come down to the wet areas not only for water, but for the succulent feed which is to be found only round these swampy flats. The encysted forms are swallowed by the sheep, take on a larval form in the stomach, bore their way into the liver through the liver capsule, and commence again their life-cycle.

SYMPTOMS.

The following short description will be useful to those sheep-farmers who are not familiar with the symptoms of liver-fluke: In the early stages (summer-time) the affected sheep are likely to improve in condition. This is only temporary, however. In the autumn the animal goes off its feed, stands apart from other sheep, does not appear so lively, and a loss of condition is noticeable. If examined, the membranes of the mouth and eyes are pale, and the same condition can be noticed in the skin. As the winter advances, œdematous swellings may be noticed under the jaws and along the belly. This condition is not constant, however, and the sheep may die without it being

apparent. The animals become feebler as the anæmia progresses, and finally die. If the infestation has not been severe enough they may survive the winter, and, as the flukes are said to leave the animals in spring, the sheep may be fattened sufficiently to get them off the place.

CONTROL MEASURES.

Treatment for expulsion of the fluke is satisfactory provided the infestation is not a heavy one. Efforts should be directed to prevent a continuance of the life-cycle. A remedy which has proved of value is a preparation of male fern. This is best given in the form of the extract, and should be administered in a capsule. This preparation is often unstable, and a guarantee should be obtained, if possible, that the drug contains not less than 20 per cent. filicine and 3·5 per cent. filicic acid. The administration of a course of four doses of about 60 minims is recommended. The sheep should be without food for twelve hours before the administration, and the course cover a period of about a week. The sheep should be kept handy in a dry paddock away from water, so that the larvæ may not have an opportunity of hatching from the eggs. Where a flock is to be treated, this should be done about May, as the danger of fresh infection will probably be over by that time. Individual sheep should be either treated for fluke or slaughtered before they become emaciated and unfit for food.

As previously stated, efforts should be directed to break, if possible, the life-cycle of the parasite, and this can most conveniently be done by destroying the snail, a native species, which is the intermediate host. Natural enemies of the snail, such as the frog, also the native swamp-birds, might be encouraged, and carp or other fish of similar habit in larger standing areas of water. Where the snail is very much in evidence, however, it will be necessary to use drastic and quicker measures. If an area is too large to deal with chemically, probably the better plan would be to fence it off so that the sheep may not graze upon it. Such an area could be used later in the season for topping off cattle or sheep which are intended for the meat-works. Any area that can be conveniently drained should be drained, and in any case it is desirable that the flow of water be centralized, thus draining the borders and reducing the area to be treated, and, of course, the cost.

Frequently small areas of swampy land occur on the hillsides, and almost without fail the snail is found when a careful examination of the grass-roots or watercress (if present) has been made. No difficulty will be experienced, where cress is present and the water running fairly rapidly, to find the snail, but a much more thorough search will be needed to find it on the roots of the swamp-grasses.

Experiments conducted in England and America have proved conclusively that the use of copper sulphate, either in a spray or applied broadcast, is very efficacious in the destruction of water-snails. This material has two other advantages to recommend it: the percentage required is relatively small, and could do little damage to stock supposing they drank the water or fed on areas that had been even fairly recently treated; and it is also comparatively cheap—a few pence per pound. Experiments conducted by the Oregon Experiment Station showed that, after estimating the volume of standing or running water to be treated, the addition of 1 oz. of copper sulphate

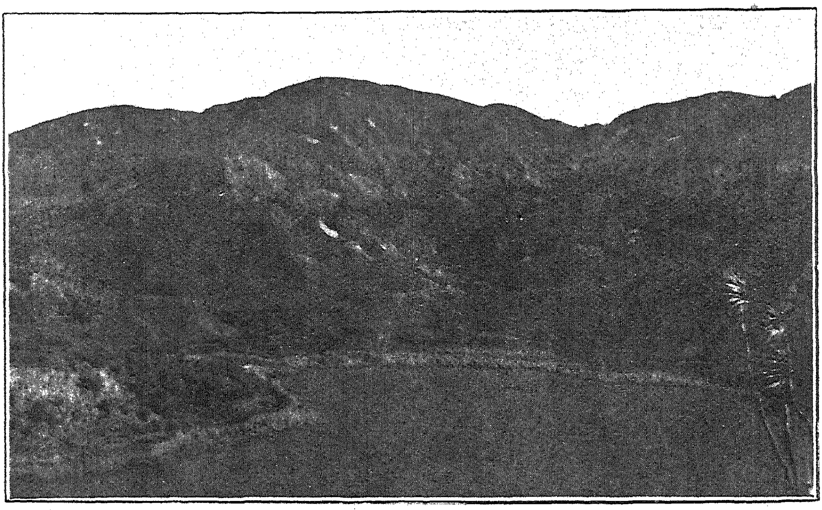


FIG. 1. SWAMPY AREA IN HILL COUNTRY.

The low-lying ground in middle of view has been a typical breeding-ground for snails. A central drain has been made, running into the lake in foreground. Such good results have followed this work that only spraying will now be necessary for fluke-control.

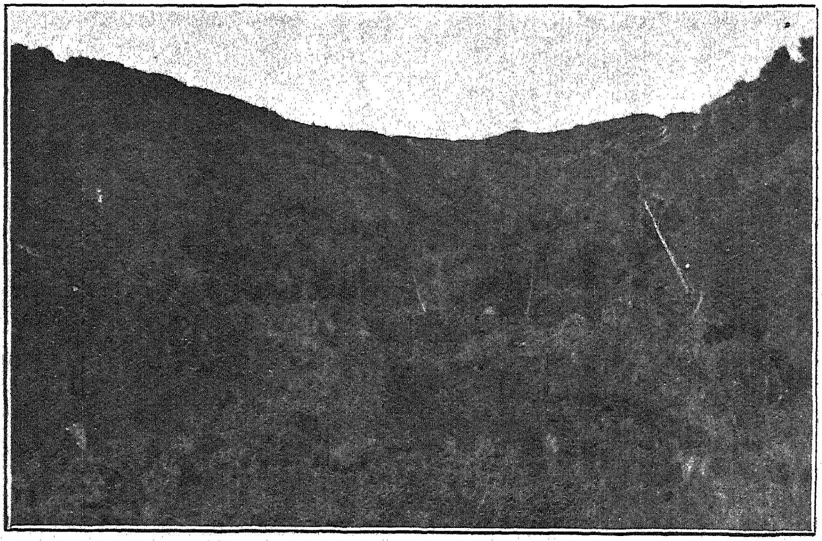


FIG. 2. SOURCE OF AN EXTENSIVE SWAMPY AREA IN HILLY COUNTRY

Situated several hundred feet above sea-level. Hillside springs on left. This place is to be drained.

[*Photos by E. E. Elphick.*

to 7,800 gallons of water was sufficient to kill snails in forty-eight hours, but the treatment had to be repeated in two to three months' time to destroy the hatching eggs.

Spraying is very suitable for damp land—not necessarily actual swamp land, but land which has been drained and still retains water. This method is not suitable for hillside areas and inaccessible places, owing to the large quantity of material, to say nothing of the spraying-apparatus, which has to be transported. Spraying is rapid in its action on the snail, and the risk to sheep is very slight. A ½-per-cent. solution should be ample for country of this class, and the cost of spraying (not including labour) works out at 8s. to 10s. per acre. Wetter areas would require a 1-per-cent. solution, and the cost would be increased correspondingly. From 100 to 150 gallons of the solution per acre should be applied, the amount varying with the density of the grass.

For large swampy areas and hillside patches the broadcast method is the most suitable. If a drain can be cut through the swamp, this should be done, as before stated, because the drain concentrates the water and reduces the area to be treated. Particular attention should be paid to springs around the edges and at the source, as the treated water running from these eventually reaches the main channel and is carried down and spreads over swampy areas lower down.

All areas should be surveyed before commencing, and the work should be carried out systematically so that none are missed. The dressings should be made in December, if possible, and not later, and the stock removed from the paddocks which are to be treated, as there is more danger of poisoning following broadcasting than with spraying. Powdered copper sulphate should be used. It should be mixed with fine sand in the proportion of 1–4 for the neighbourhood of springs and the source of a swamp, and 1–8 for small swamp areas on hillsides, &c. A few pounds could be taken out on the saddle in a sugar-bag, and any small areas that are holding snails could be hand-dressed when doing the ordinary rounds of the sheep.

All sheep dying from fluke disease should be buried, and not left to rot near a water source or swamp. Any liver found to contain fluke should either be buried or burned.

Since the foregoing was written an article by R. F. Montgomerie, D.Sc., F.R.C.V.S., University College of North Wales, has appeared in the *Journal of Comparative Pathology and Therapeutics*, in which the writer advocates the use of 1 c.c. doses of carbon tetrachloride in capsules for fluke disease. A large number of experiments carried out by him gave very good results.

Tobacco-growing in New Zealand.—The annual report of the Horticulture Division for 1925–26 states: "Considerable interest is still being evinced in the cultivation of tobacco as a commercial proposition, and a steady increase is noticeable in the area planted in this crop. It has been amply demonstrated that leaf of high-grade quality for pipe-smoking can be produced in certain localities in the Dominion, notably Nelson, Hawke's Bay, and Auckland. It is estimated there are now some 400 acres under cultivation, the crop being grown under contract to tobacco-manufacturers. The continued improvement that has taken place in the manufacture of locally-grown tobacco has led to a considerable demand for the New Zealand product."

GALLOWAY IRRIGATION FARM.

I. ESTABLISHMENT AND INITIAL OPERATIONS.

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SITUATED some five miles from the town of Alexandra, the Galloway Irrigation Farm lies in the heart of the semi-arid region of Central Otago. Its area comprises approximately 149 acres, of which 89 acres are served by water brought by races from the Manorburn Dam. Central Otago, on account of its limited rainfall, ranging from 13 in. to 20 in. per annum, is dependent to a very large degree on the application of irrigation water for the successful growing of crops and pastures. As a result of this necessity several Government and private irrigation schemes have been established with a view to making ample provision of water. With the advent of irrigation on modern lines the Department of Agriculture therefore decided to establish an irrigation farm, where certain practices under the comparatively artificial conditions of irrigation could be tested.

It was realized that although irrigation was of great antiquity its practice necessitated considerably more energy and forethought than farming under ordinary humid conditions. Bearing in mind that the average settler in Central Otago knew very little of applied irrigation, it was recognized that the establishment of a farm on a typical piece of Central Otago country, where modern practices could be demonstrated and definite investigations made, would be of decided value to the irrigation districts.

After careful consideration had been given of the different soil conditions and grades of country typical of Central Otago, a portion of the Galloway Station was selected as being ideal for the purpose of experimentation, in that all types of soil and grades of country common to the district were represented.

THE FARM AND ITS SCHEME OF WORK.

Although situated in the midst of the mica-schist region of Central Otago, the Galloway Irrigation Farm has not a typical mica-schist soil, nor has the surrounding country the usual topography generally found in schist regions, except where the farm skirts the foothills of the Raggedy Range. The reason for this peculiarity of Galloway Flat lies in the fact that the soil consists largely of lacustrine and fluviatile deposits mingled with igneous rock-flour and what are probably ice-borne boulders. These stones, often of considerable size, and not always definitely river-worn, are almost entirely foreign to the locality, and must originally have come from the western part of the Lakes district, this being proved by comparison of their composition with that of the country rock of western Otago. A classification of the soils on the Galloway farm therefore becomes difficult, bearing in mind the variety of constituents which have gone to form the surface.

The land comprising the farm is mainly at two levels, the lower fields being flat and part of the recent flood-plain of the Manuherikia

River, while the upper levels are above the Government main race. On the slope between the two levels is a small terrace on which, where it widens out to form a gully cutting into the old lake-bed, stands the farm steading.

On the upper level, above the race, is an area of what appears to be a comparatively rich black soil several inches in depth, but owing to the absence of water it is at present practically unproductive. On the faces between this flat and the race bare shingle appears, owing to the finer materials having been washed down to the lower levels. Below the race, where water can be turned on to this bare shingle, quite good grazing-ground can be formed, as the plant-roots, &c., have the effect of binding the soil, thus making it more retentive and greatly enhancing its production. Still lower down

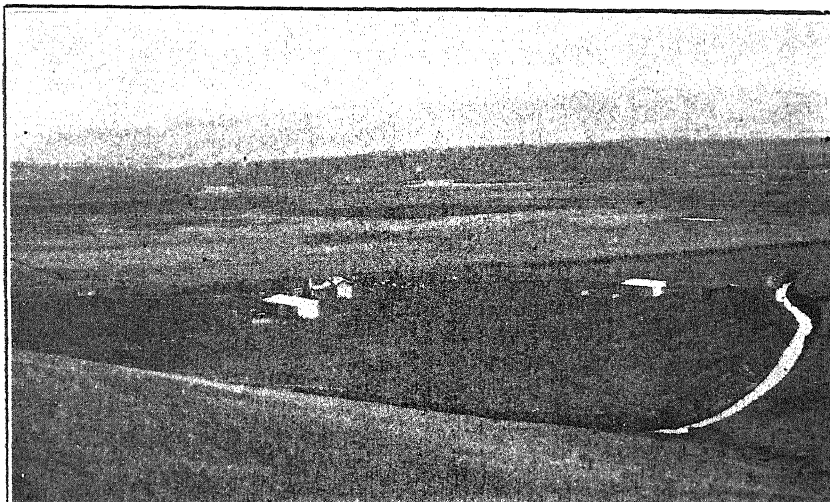


FIG. 1. VIEW OF GALLOWAY FARM TAKEN FROM ABOVE THE MAIN IRRIGATION RACE.

Note the absence of trees on the distant plains, and the young shelter-belt on the farm.

the faces, on a small terrace which probably marks the level of an earlier flood-plain of the Manuherikia, about 3 in. to 5 in. of good soil is found, overlying an average of 7 in. of silt and clay, which in its turn is followed by gravel consolidated by river-silt. On the flat, lower levels of the farm the soil has a large proportion of gravel and stones, without the appearance of the clayey subsoil which characterizes the upper fields.

An interesting feature which attracts attention is that in the gullies which intersect the high terrace there is a marked variation of soil. On the northern faces there is a depth of 8 in. to 10 in. of rich black soil, now covered with a luxuriant growth of clover and grasses, while on the southern face very little soil at all, but rather bare consolidated gravel, appears with little or no plant-growth. This may be accounted for by the prevailing rain-bearing winds, which, beating on the southern faces of the gullies, wash the soil away.

When Galloway farm was taken over by the Department in 1921 the vegetation existing thereon was of an extremely sparse nature, the country being practically denuded, and carrying roughly one sheep to 10 acres. What growth did exist was comprised largely of the desert poa (*Poa maniototo*), scabweed (*Raoulia lutescens* and *australis*), Californian thistle (*Cnicus arvensis*), desert colobanth (*Colobanthus brevisepalus*), hair-grass (*Aria caryophyllea*), wild geranium (*Erodium cicutarium*), stinkweed (*Gilia squarrosa*), abundance of sorrel (*Rumex Acetosella*), and other vegetation of a similar nature. The place in its naturel state, as can be seen from the accompanying photograph (Fig. 1), looked most uninviting, and it was difficult to realize that with the application of water an apparently sterile piece of country would respond by growing excellent crops.

FIG. 2. TYPICAL GALLOWAY LAND BEFORE THE COMING OF IRRIGATION.

Sparse vegetation, consisting of desert poa, scabweed, hair-grass, wild geranium, stinkweed, and sorrel. Stones numerous. Carrying-capacity, one sheep to 10 acres.

At this early stage of the farm's history the proposed scheme of work was as follows :—

(1.) Determination of the best method of distributing irrigation water, paying special attention to the cost of labour involved in the distribution, and of the economical use of water.

(2.) Crop trials to determine what crops would most profitably grow under irrigation in Central Otago. This work to include careful crop-costing.

(3.) Experiments to determine the cultural and water requirements of crops under irrigation.

(4.) Attention to drainage problems which might probably arise consequent on irrigation.

(5.) Investigation of alkali in Central Otago soils.

(6.) Investigations of dry farming or any other methods of cultivation on that portion of the farm which cannot be irrigated.

DAIRY-FARMING.

With the foregoing initial programme of work in view operations commenced, but in the course of time financial considerations, and the impossibility of obtaining the services of a well-trained investigator to reside on the farm, resulted in the original programme of investigations being considerably modified. Shortly after the inception of the farm it became apparent that a very definite demonstration of dairy-farming in irrigated country would be most desirable, with a view to ascertaining its possibilities on comparatively small holdings, and at the same time giving a lead to other settlers desirous of taking up this type of farming. The somewhat precarious and unstable condition of the fruit industry emphasized the necessity of utilizing irrigation areas for other purposes besides fruitgrowing, and dairying offered the most reasonable likelihood of an assured income and comfortable livelihood. The chief work at present being carried out at Galloway Irrigation Farm, therefore, is the production of butterfat.

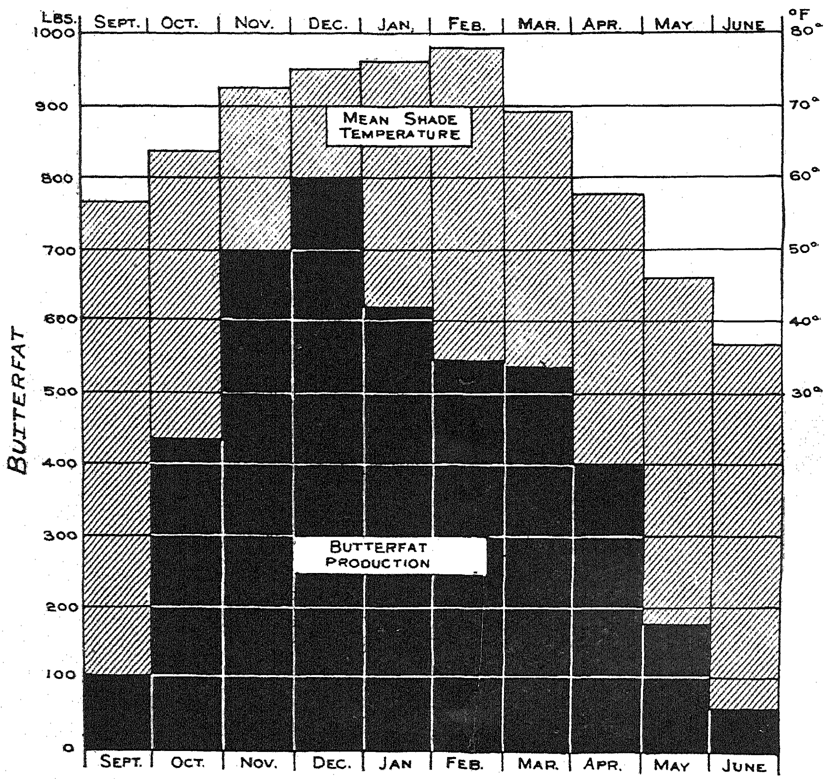
The dairy herd at the time of writing is in the main composed of purebred Ayrshire cattle. In all there are fifty-seven head of stock on the farm, of which thirty are Ayrshires, four Red Polls, and the remainder crossbred animals. The policy is the establishment of a high-producing herd of Ayrshire cows, and to this end stock of some of the leading southern breeders has been obtained, the progeny of the herds of Messrs. A. S. Weir, Irvine, Herron, and Ireland being well represented.

The Ayrshire appears to be ideally adapted to Central Otago conditions. Its hardy nature is eminently suited to the rigorous conditions prevailing throughout the winter months, when very heavy frosts are experienced. The breed winters exceptionally well on lucerne hay alone, and when given a fair ration of this feed the cows invariably "come in" in the spring in first-class condition. That such is the case is very fortunate, in that the growing and conservation of lucerne hay in Central Otago is a much more attractive and assured proposition than the growing of root crops.

Testing has been carried out regularly on the farm, and thus individual records of each cow are known. Culling the unprofitable animals will be carried out as soon as full stocking-capacity has been reached, thus assuring the rapid establishment of a herd of average high producers. The production of the herd at present is only moderate, last year's average being 238·26 lb. butterfat per cow. It is interesting to note the monthly returns of butterfat from the herd for the past season, together with the minimum temperatures recorded, as shown in the following table :—

Month.	Yield of Butterfat.	Shade Minimum Temperature.	Month.	Yield of Butterfat.	Shade Minimum Temperature.
	lb.	F.		lb.	F.
September, 1925	106·13	57°	February ..	550·46	78°
October ..	438·38	64°	March ..	541·65	69°
November ..	704·54	72°	April.. ..	402·66	58°
December ..	807·83	75°	May	184·68	46°
January, 1926 ..	620·46	76°	June	50·00	37°

The accompanying graph shows the bearing which temperature has upon milk-yield. It will be observed that the three hottest months of the year are December, January, and February. The herd reached its maximum yield during December. From then onwards, throughout the months of January and February, as the effect of the temperature was felt upon the growth of the grass and the animals, the yield of milk rapidly decreased. With the cooler month of March a lessened decrease in quantity of butterfat was observed.



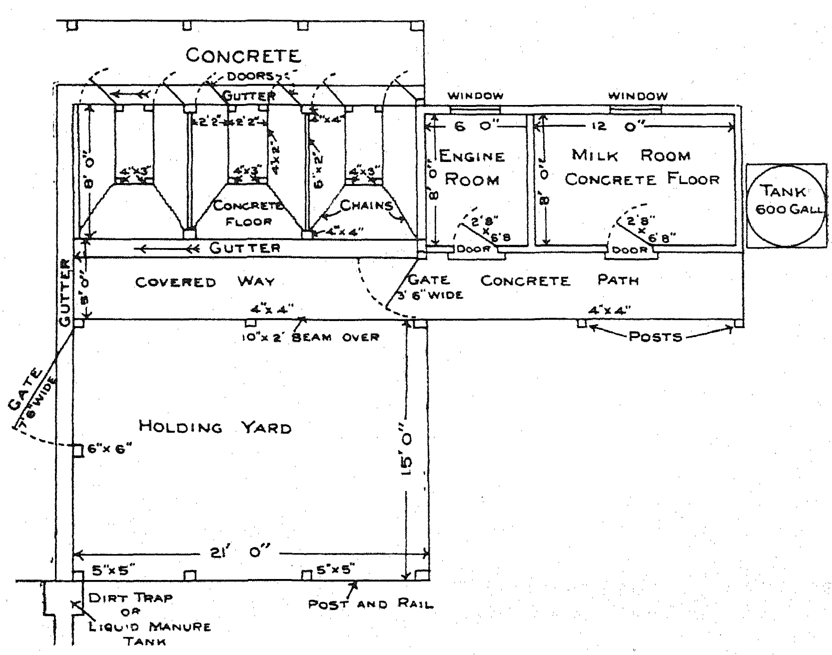
GRAPH SHOWING RELATION OF TEMPERATURE TO MILK-YIELD AT GALLOWAY FARM, 1925–26.

The two most critical months of the year at Galloway normally are January and February. During that period the pastures do not yield a succulent growth, and consequently, if no supplementary crops such as millet or oats are grown to provide feed, a rapid drop can be looked for in the yield of the herd. As a general rule, therefore, where dairying is being carried out in Central Otago the provision of a summer supplementary crop should be regarded as sound practice. The possibility of successfully grazing lucerne during these two months has not as yet been fully investigated, but dairy-farmers as a whole feel diffident (not without cause) of putting their cows on lucerne, in view of the danger of bloating.

Further reference to the graph will show that the cows are inclined to be late in realizing their peak of production. If possible, the peak should be brought forward to November. This will mean calving a month earlier than has been our custom, and in such a case provision for early spring feed is necessary. It is to be remembered that the spring growth here does not take place until September, and if the cows calve in August no grass is available for grazing. The practice at Galloway has been the sowing of Emerald rye-corn in the autumn. This crop grows satisfactorily throughout the winter months, and by the middle of August provides succulent grazing.

THE MILKING PLANT.

The facilities for milking at Galloway are modelled on the most up-to-date methods combined with moderate cost of installation. The milking-shed proper is of the walk-through type, with accommodation for eight cows, four being milked while the other four are being stripped. The bails are fitted with thigh-chains. The walk-through doors are of a very simple and efficient type, operated by means of a simple hand-operated lever. The precincts of the milking-shed, engine-room, and vat and separator room are concreted, this keeping the place clean, wholesome, and free from offensive odours, and also facilitating the hosing-down and sweeping-away of manure. Ample drainage provision has been made to take away all surface water with its obnoxious contents. The engine-room is compact, well equipped, and contains a 3-horse-power oil-engine with the necessary shafting, driving-gear, and rotary air-pump. The milking-machine



PLAN OF MILKING-SHED, ETC., AT GALLOWAY FARM.

plant is of the releaser type, and has proved very satisfactory. The separator and releaser room is fitted with a 50-gallon receiving-vat, and also contains a testing-machine and necessary equipment. The washing-up trough is situated outside the milk-room on the veranda, hot water being abundantly supplied by a twin circulator and a water-heater. An abundant service of hot water is available at all times. The milking-shed has been in operation for two seasons, and experience has shown that the plant as a whole is excellently suited to the conditions existing in Central Otago.

PASTURES AND LUCERNE.

As will be the case on any dairy farm in Central Otago, the two chief crops are, firstly, irrigated grass, and, secondly, irrigated lucerne. Where one can successfully grow these two crops there should be little need to fear that dairying cannot be carried out with success. As has already been pointed out, additional crops for the provision of early spring and early summer feed are to be recommended, but with good stands of lucerne the dairy-farmer has ample provision for his winter-feed requirements, and need not unduly worry about the provision of roots for the winter months. The Galloway farm pastures are of a permanent nature, being chiefly composed of perennial rye-grass and white clover. These two types of pasture plants thrive remarkably well, and should certainly be dominant in the seed mixtures used in establishing pastures on irrigated country. Very little cured hay or green lucerne is used for feeding cattle or sheep during the summer months, as the farmer looks for grass pastures to supply the bulk of the summer feed. The average irrigation farmer usually keeps a small flock of sheep in addition to his dairy cows and horses, and where such is the case good irrigated pastures are essential.

Central Otago is well adapted to the growing of pasture grasses and clovers, for, with a good supply of water, coupled with a soil low in lime-requirement and the presence of almost continuous sunshine, conditions are ideal. In laying down the pastures at Galloway the aim has been to obtain a judicious mixture of grass and clovers in such a proportion as to produce a palatable sole with a high feeding-value. It is recognized that there is no single species having all the characteristics that are looked for in an irrigated pasture. A mixture of several varieties of grasses and clovers is usually desirable. The different grasses have varying times of maximum growth, and since with the aid of water the pasture can be maintained in good growing-condition throughout the entire irrigation season it is quite necessary that a mixture should be sown containing some early, medium, and late growing varieties.

The main grass-seed mixture used on the farm is composed of 16 lb. perennial rye-grass, 6 lb. cocksfoot, 4 lb. timothy, 1 lb. Poa pratensis, 2 lb. alsike clover, and 1 lb. white clover—a total of 31 lb. per acre. On the steeper hilly faces which were cultivated with the disk and tine harrows alone a simpler mixture was sown, this being made up of 16 lb. perennial rye-grass, 6 lb. cocksfoot, 2 lb. alsike, and 1 lb. white clover—a total of 25 lb. per acre.

Full particulars of the method of sowing the pastures and their subsequent irrigation and utilization were given in this *Journal* for

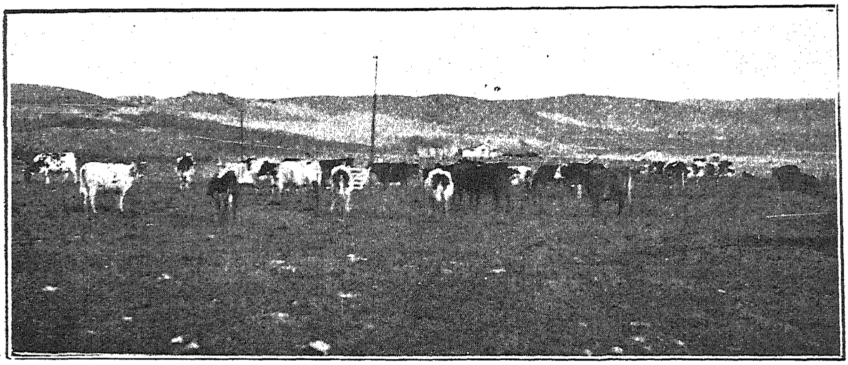


FIG. 3. PART OF THE DAIRY HERD AT GALLOWAY FARM.

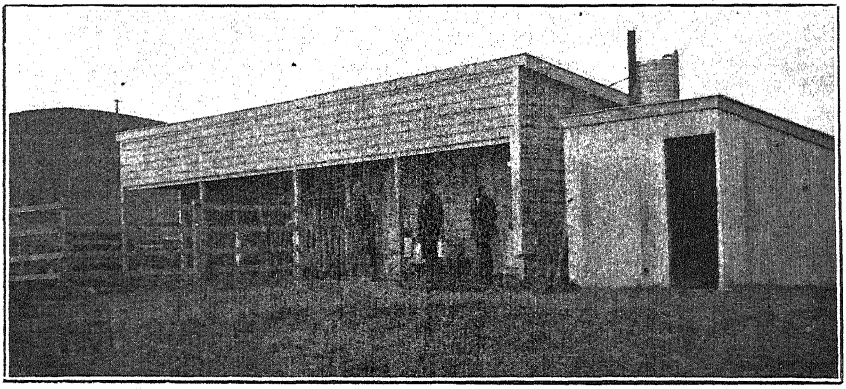


FIG. 4. THE DAIRY PREMISES.

Milking-shed of walk-through type; separator and testing room, and engine-room, attached.

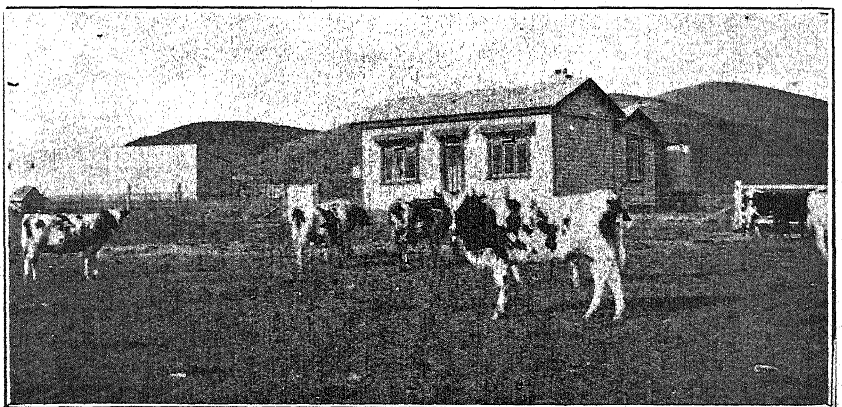


FIG. 5. OVERSEER'S COTTAGE, AND (ON LEFT) STABLE AND IMPLEMENT-SHED.

Note good winter condition of dairy stock seen in foreground, due to feeding of lucerne hay and ensilage.

February, 1925, and embodied in Bulletin No. 120, "Irrigation." The carrying-capacity of irrigated pastures is undoubtedly very high. The total grazing-stock carried at Galloway during the past season was fifty-seven head, or one animal to 1·5 acres. When the farm is fully stocked it is anticipated that fifty head of milking-cows, ten young cattle, and six other animals can be successfully carried on the 89 acres of irrigated land without recourse to buying feed. If this is realized, then the carrying-capacity will be one head to 1·3 acres—a very creditable performance, and one which will speak highly of the capabilities of Central Otago.

An area of 18 acres is devoted to the growing of lucerne, one field being irrigated by the border and the other by the contour method. Lucerne, as has already been stated, thrives excellently in Central Otago, and on the Galloway farm very good yields are obtained. Two main types of soil are utilized in the growing of lucerne, one a gravelly river-bed soil and the other a deep clay loam. As might be expected, the yields per acre are higher on the heavy soil than on the lighter, the loam field yielding 5 tons of cured hay per acre, against 4½ tons from the gravelly soil. Weed invasion is guarded against by frequent cultivation of the crop by spring-tooth harrows or a grubber. The cost of labour for harvesting in Central Otago is high, and the cost of conserving lucerne hay when horse-drays are used is in the vicinity of £1 5s. per ton. Much can be done in the way of investigating cheaper methods of hay-conservation, and it is intended during the present season to deal with this aspect of the matter. Full particulars of the method of sowing and irrigating lucerne as practised at Galloway were given in the *Journal* for December, 1924, and included in Bulletin 120.

LUCERNE ENSILAGE.

During the past season the conversion of lucerne into ensilage was undertaken with a view to ascertaining the cost and to find out the value of the ensilage as winter and early spring supplementary fodder. The silo constructed was of the hillside type. A suitable sloping bank existed on the farm in close proximity to the lucerne-field and in a handy position for feeding ensilage out to stock. This bank, furthermore, had a natural washout caused by a breakaway in one of the irrigation ditches in days gone by. This saved a considerable amount of digging out that would otherwise have been required, and the pit location was accordingly an ideal one. When the material was dug out it was utilized to build up a road through a low part of the farm; thus two permanent improvements were effected at the same time. The cost of constructing the pit was: Labour, £28 10s.; timber, £19; concrete, £1 13s.: total, £49 3s.

The ensilage was made from the second cut of lucerne, at a cost of £17 2s. for labour, horses, meals, &c. Taking the interest and depreciation on the silage-pit at £5 10s., the total cost was £22 12s. The weight of silage in the pit came to approximately 50 tons, the cost thus being just over 9s. per ton. This cost appears to be reasonable, particularly when it is borne in mind that high labour rates prevail throughout the district. Although the silage when opened up was not of the best quality, evidently having been allowed to over-

heat, it was relished by the stock and little wastage resulted. The difficulty of getting the first cut of lucerne into stack in Central Otago would apparently warrant its conversion into ensilage. Often on the farms of this district a large surplus of grass is obtained which cannot be controlled by stock. The utilization of this grass by making it into ensilage would undoubtedly be a step in the right direction, and when so conserved the material should prove a valuable asset to the dairy-farmer or sheep-farmer during the winter months.

In recording the farm operations special mention must be made of Mr. W. Faithful, the Overseer, whose untiring energy and interest in the welfare of the farm have largely brought it to its present state of productivity.

(To be continued.)

POSITION OF THE CATTLE-TICK.

THE annual report of the Live-stock Division for 1925–26 states: "Although the cattle-tick does not show any diminution within the A area, it does not show any tendency to spread within the area known as B, and may actually be said to have decreased or almost disappeared from some districts where it was previously found. This satisfactory position indicates that the policy of spraying cattle or otherwise destroying the ticks when they first make their appearance is a good one. In Waitara district the quarantine area had to be enlarged owing to some ticks having been found on a farm immediately outside the original area. Within the area quarantined a few ticks were found during the season, but the prospects for complete eradication are hopeful. During the year a dip was erected by the Department at Mohakatino, near the northern boundary of Taranaki, and all cattle proceeding south are required to be dipped. A dip has also been erected at Waitara by the combined efforts of the settlers concerned, and all cattle leaving the quarantined area are dipped, and all other possible precautions have been taken to prevent the spread of the tick."

In some general remarks on this subject in his annual report for the same period the Director-General of Agriculture states: "The ticks found on cattle and other animals in the northern part of the Dominion have continued to be harmless so far as any ill effect upon the health of the animals is concerned. A systematic series of experiments which, after several failures to get them started owing to the ticks supplied dying, have been carried out at the Queensland Government's laboratory, at Townsville, indicate that these ticks — unlike the so-called 'Queensland tick' — are incapable of transmitting tick-fever from animal to animal. As these ticks progress southwards in the Dominion they seem to find it increasingly difficult to establish themselves, especially when away from the coastal areas, and a number of farms where they at one time appeared in small numbers are now quite clear of them. They damage hides when present in sufficient number, and this point needs special attention, and in itself warrants farmers doing all that is possible to eradicate them."

Export of Stud Stock.—The numbers of stud stock exported from New Zealand during the year 1925–26 were: Sheep, 2,692; cattle, 130; pigs, 10. Of the sheep exported, 353 were for the Falkland Islands, this being indirectly the result of the Government having loaned to the Falkland Islands Administration the services of Mr. H. Munro, of the Department of Agriculture, to report on the position of the sheep industry there.

Cidermaking.—It is estimated that in the year ended 31st March, 1926, some 50,000 gallons of cider, valued at approximately £12,500, were produced in the Dominion.

THE GRASSLANDS OF NEW ZEALAND.

SERIES II. NORTH ISLAND HILL COUNTRY.

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

GRASSES AND CLOVERS FOR HILL COUNTRY.

(4.) Crested Dogstail (*Cynosurus cristatus*).

CRESTED DOGSTAIL is commonly widespread on hill country, but it does not occupy the same general position as does Poa pratensis. In the writer's opinion this is largely due to the fact that crested dogstail has not been sown nearly so generally on the original primary-forest burns as has Poa pratensis. Again, crested dogstail, being a tufted or diminutive tussock-forming grass (Fig. 83), has not nearly the staying-powers under difficult situations that a grass like Poa pratensis has with its creeping underground-stem system.

Crested dogstail ranks in fertility-requirement with Poa pratensis and cocksfoot. These three species make up a fairly definite group—below perennial rye-grass in fertility-requirement on the one hand, and just above the brown-top standard of soil-fertility on the other hand.

Crested dogstail prefers rather moist soil conditions, and thrives best on somewhat consolidated soils, being in this respect somewhat similar to rye-grass. It will not endure shade, and is most readily smothered out by rank growth of cocksfoot, &c. (Fig. 84), or by any form of secondary growth. This inability to withstand the smother of rank cocksfoot probably largely accounts for the paucity of crested dogstail existing on much of the hill country grassed years ago, the practice of spelling the burn and harvesting cocksfoot-seed being decidedly inimical to the persistence of crested dogstail. Ranking as this grass does in fertility-requirement with cocksfoot, the places it would thrive best in and where it would be seen in its true form are where the soil conditions favour a strong growth of cocksfoot. As before stated, a rank growth of cocksfoot is fatal to crested dogstail. Those areas, therefore, that were spelled for seed-production in the early days, or which got away rank and which now are cleaned up and are under ordinary grazing-conditions, are liable to contain practically no crested dogstail in the sward to-day.

In the past crested dogstail has not been a very popular grass with many farmers, and its unpopularity may be largely attributed to its tendency in the first year or two to bolt away rapidly to seed in the early summer, and during its seeding-period to fall away almost entirely so far as the production of leaf is concerned. Very few farmers can recognize crested dogstail in the vegetative stages. When in seed most can recognize it, but when shown the plant in the vegetative stage the majority mistake it for perennial rye-grass. This fact, together with the tendency of the grass to bolt away to seed as mentioned, is largely responsible for its unpopularity.

Crested dogstail is essentially a winter and early spring producing grass, and during those periods it may even surpass rye-grass in production, particularly so on soils not quite good enough for

FIG. 83. GROWTH-FORM OF CRESTED DOGSTAIL.

A tufted, diminutive tussock-forming grass whose crown is slightly below ground. Owing to this growth-form, dogstail is unable to spread vegetatively as does Poa pratensis.

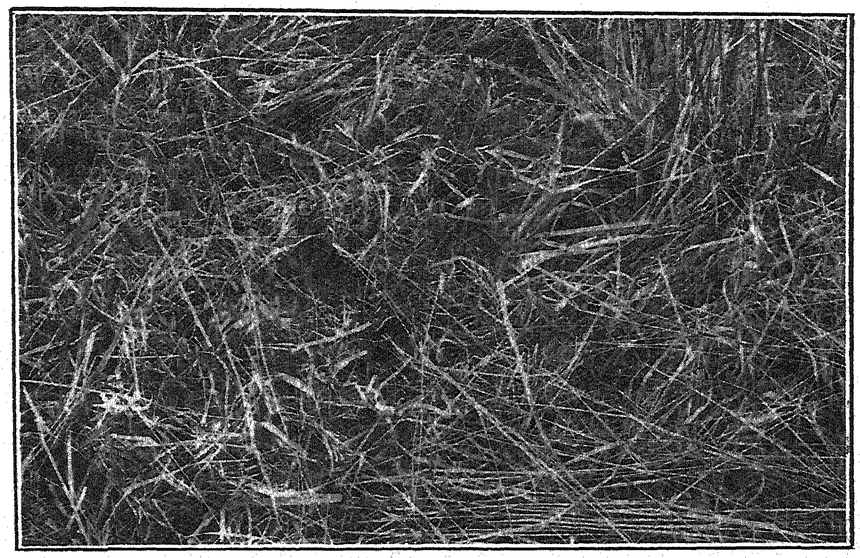


FIG. 84. CRESTED DOGSTAIL KILLED OUT IN ONE SEASON BY RANK GROWTH OF COCKSFOOT.

Spelling bush-burns for cocksfoot-seed production—so common in the early days—must have considerably reduced the amount of crested dogstail that had become established in those pastures. The long stalks shown in foreground of photo are crested dogstail; the plants that produced them were quite dead when photo was taken. [*Photos by E. Bruce Levy.*

very great value on the better class of hill country. The grass is early to come away in the spring, and this, again, coupled with the high palatability of the leafy foliage, makes it a highly desirable constituent of any pasture, particularly in regard to pastoral lands. One of the finest sights is to see sheep grazing on rolling hill-country pasture which contains a good proportion of crested dogstail. It is this grass that really gives that rich dark-green appearance to such pastures in the early spring.

It is, however, only on the more fertile aspects of hill country in general that crested dogstail presents this early spring feed and adds so to the attractive appearance and grazing-value of the pasture at that period (Fig. 87). Just as in the case of Poa pratensis, cocksfoot,

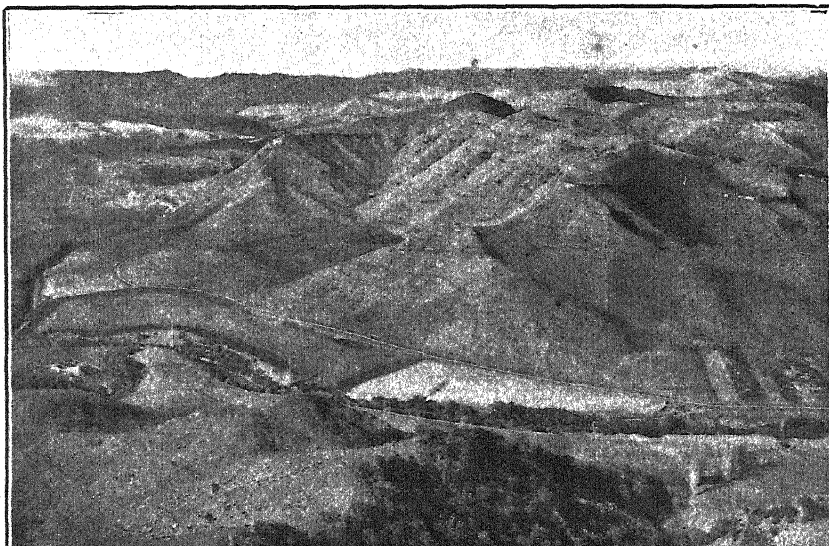


FIG. 87. FOOTHILLS AND EASIER ROLLING COUNTRY IDEAL FOR CRESTED DOGSTAIL.

Mr. Burridge, Moawhango, from whose farm the photo was taken, was particularly struck with the early feed produced, and with the way sheep stuck to the lower slopes of this country in the early spring. Crested dogstail was doing excellently on the slopes. [Photo by E. Bruce Levy.

and rye-grass, so does crested dogstail decline as the soil-fertility becomes reduced. The reseeding and re-establishment phase is really the beginning-of-the-end phase of crested dogstail so far as high production is concerned. Unless fertility is in some way increased these seedlings soon present a yellowish appearance, and many do not develop much beyond the seedling stage. Those that do survive remain as small, stunted plants, and the original old plants decline greatly in size. No more tillers from the crown are formed, and the plant persists as a mere vestige of one small shoot which scarcely ever puts up a seed-head. Those plants that do manage to seed generally die right out after the seed ripens. Under the poor conditions now existing in such a pasture, re-establishment from any seed shed is practically impossible, and crested dogstail may finally die right out of the pasture, except

in a few more favoured spots where fertility is not so depleted. This, together with rank smother conditions that may have occurred in the pasture's history, probably accounts more or less for the often rather erratic distribution of crested dogstail over any hill-country area.

It may be said in regard to the deterioration of grazed pastures that if crested dogstail is running out as a result of fertility depletion there is no hope for rye-grass, cocksfoot, or Poa pratensis remaining as high producers on that area. Crested dogstail really is about the last of these four to go. All will persist for years as vestiges in the pasture, but dominance will have changed in favour of one of the inferior grasses—brown-top, danthonia, or ratstail—or of certain weeds such as catsear, hawkweed, rib-grass, cudweed, &c., or of secondary growth.

POSITION OF CRESTED DOGSTAIL SUMMARIZED.

Summing up the position occupied by crested dogstail at the present time, one finds that it is essentially a bottom grass that can be readily smothered out of a pasture by rank growth of cocksfoot, &c. It thrives best on a moderately fertile soil, fitting admirably in this respect as an associate species with cocksfoot and Poa pratensis. Consolidated conditions rather than loose soil conditions, and wet soils rather than dry soils, favour the persistence and spread of this grass. Spread of crested dogstail is brought about entirely by seed, the plant being tufted, with no means of lateral vegetative spread. The free-seeding attribute of the grass, together with the ease with which the seeds germinate and establish even under rather hard conditions, make for temporary dominance of this grass during that period between the weakening and running-out of rye-grass on the one hand, and the coming-in of sweet vernal, Yorkshire fog, and brown-top on the other hand. The better slopes of the hill country where there still persists a certain amount of perennial rye-grass, cocksfoot, Poa pratensis, and white clover are the most favoured situations for crested dogstail. It will persist as vestiges for many years in weak, open turf, or with a brown-top or danthonia dominant pasture; but, as one would expect, the yield from crested dogstail falls to practically nothing within a danthonia turf, particularly so on the drier aspects.

As before mentioned, crested dogstail will not endure shade, and therefore as a grass to use in the combating of secondary growth it is of practically no value once such growth becomes dominant on the area.

CRESTED DOGSTAIL IN PRIMARY AND SECONDARY BURNS.

The writer is of opinion that not enough crested-dogstail seed has been included in mixtures, either for primary or secondary burns. The ease with which this grass establishes, even on the poorer aspects of the burn, and the comparatively rapid growth made by the young plants, together with the ability of the grass to persist on the country even after the disappearance of perennial rye-grass, coupled with its high palatability, make crested dogstail one of the most desirable for all hill-country sowings. An amount of 3 lb. to 4 lb. per acre should be included in the mixture.

As far as the secondary burn is concerned, we are finding in our experimental work at Whangamomona that crested dogstail is one of the best and cheapest seeds to use, and for the last two seasons this grass, together with brown-top, has been the base of all sowings on secondary burns. The great ease with which the plant establishes from seed, and the fact that it lasts longer than rye-grass on these hard faces, incline us more and more to use this seed in preference to perennial rye-grass. On the harder slopes and knolls the grass, of course, will not yield at all highly. It establishes there quite well, but seldoms tillers out, and remains as a weak, stunted plant of one shoot. On the rather better slopes and aspects, however, the plant tillers well, and soon produces quite a nice bite for sheep. In this respect it is, of course, not quite so rapid as rye-grass, provided conditions are good enough for the latter, but its establishment is more certain under the average conditions existing on the secondary burn. An amount of 3 lb. to 4 lb. of crested dogstail per acre should also be included in all secondary-burn mixtures.

The seed of crested dogstail at the present time is expensive, being in the neighbourhood of 2s. per pound. At this price, of course, the inclusion of 4 lb. in the mixture adds considerably to the price of the latter, but the writer feels that under the conditions stated 6s. to 8s. spent on crested dogstail will pay better than the same amount spent on any other seed, with perhaps the exception of brown-top and white clover. Owing to the fact that crested dogstail is proving one of the best grasses for hill-country sowing, the considerable rise in price of the seed from 10½d. per pound in 1924 to 2s. per pound in 1926 is much to be deplored, both from the merchant's and the sower's point of view. Hill-country mixtures must be kept cheap, and it simply means that when seed is at a high price less of that seed is sown in any one mixture, satisfactory results from the smaller sowings are not secured, and the farmer is apt to give up the sowing of his secondary burns altogether, trusting to luck that a little suckling-clover, Yorkshire fog, sweet vernal, &c., will spring up naturally after the burn and give a certain amount of feed—until these grasses are again smothered out by the return of the secondary growth. At the present time, according to Mr. N. R. Foy, Seed Analyst (Biological Laboratory), the present high price of crested dogstail is due to a world shortage of this seed owing to the failure of last season's crops. The normal price of crested dogstail varies from 1s. to 1s. 3d. per pound.

Crested dogstail, apart from the feed it produces (thus enticing stock to work on the area), is of no value in the prevention and control of secondary growth. As soon as the crown becomes shaded by any type of growth the plants may die out completely within one season. This fact certainly does limit the usefulness of crested dogstail in situations where the secondary growth may come back and may have to be burnt several times before it is finally overcome. With crested dogstail it is a matter of sowing more seed each time the secondary growth is burnt off, whereas with Poa pratensis and certain other species the reseeding of the burn once these plants are established on the area may not be necessary.

MAINTENANCE OF SOIL-FERTILITY.

With regard to both crested dogstail and Poa pratensis, one must again emphasize the prime importance of maintaining moderately fertile soil conditions. These grasses will yield well, and are excellent bottom grasses for all types of hill country where fertility can be built up and maintained. Once, however, the soil-fertility falls, so that brown-top, danthonia, ratstail, &c., gain in the pasture, little growth can be expected from either of these two species. As with cocksfoot, so with crested dogstail and Poa pratensis, the vestiges of these species are still plainly discernible in most of the worn-out and deteriorated grass swards, It is not too late at this stage to apply manure to those plants to enable them to come back to their former state of production.

(Series to be continued.)

CONTAGIOUS ABORTION AND STERILITY IN COWS.

THE annual report of the Live-stock Division for 1925–26 remarks on the subject of contagious abortion and sterility in dairy herds as follows :—

These troubles are still responsible for a considerable loss to dairymen, although in the case of contagious abortion most districts report a marked decrease of actual abortions as having occurred. This is probably the effect of acquired immunity, which is a particular feature of the disease. In the case of sterility, however, the trouble is still prevalent, and has been more or less general. It is a problem calling for close investigation in field and laboratory, and during the year a large amount of special investigational work has taken place. This is being continued, and it is hoped that with closer study of the various genital affections now existing among the cows some solution of the problem will result. A number of veterinary officers have been concentrating on this disease in association with the Wallaceville Laboratory staff. Officers have also been giving lectures throughout the dairying districts with a view to assisting farmers to deal with these troubles to the best advantage with the knowledge already gained. The work done on sterility at Wallaceville during the year has been mostly in continued observation of herds known to be affected with abortion, granular vaginitis, or temporary sterility ; in watching the result of herds feeding on calcium phosphate ; and in the use of vaccines, both live and dead. This latter has been carried out only on a very small scale, because of the necessity for suitable conditions in the herbs used. An experiment is in course of construction at the Laboratory to see (1) whether it is possible to build up an absolutely free herd from the affected herd ; (2) whether abortion-free herds have the same amount of temporary sterility as affected herds.

THE WILD PIG NUISANCE.

THE Departments of Agriculture, Lands, and the Forest Service again assisted to alleviate the wild pig nuisance in certain parts of the North Island. Up to the 30th November, 1925, the Forest Service, in its capacity as organizing and controlling agent, collected and paid out the bonus upon 17,227 wild pig snouts in the Wellington conservation region. Arrangements have been made whereby all persons who presented wild pig snouts for counting and payment before the 30th November, 1925, but after the exhaustion of the appropriation, will be paid the bonus during the current financial year. During the latter part of the period under review the system of granting a bonus for the destruction of wild pigs was extended to cover a portion of the Opotiki County, with the result that 2,026 wild pig snouts were destroyed in that district. The payment of the bounty has been responsible for the total destruction of 19,253 wild pigs in the aforementioned infested areas. For the current year the Departments of Agriculture, Lands, and the Forest Service have again joined financial forces to continue operations for the destruction of wild pigs in the North Wellington, Taranaki, and Opotiki districts.—*Annual Report of State Forest Service, 1925–26.*

RAPE MANURIAL EXPERIMENTS IN CANTERBURY, SEASON 1925-26.

A. W. HUDSON, B.Agr., B.Sc., Instructor in Agriculture, Christchurch.

A FURTHER trial of the manures used for the rape manurial experiments in the preceding season (see *Journal*, November, 1925) was made in 1925–26 on the farms of Mr. J. Symes, Darfield, and Mr. R. S. Gunn, Racecourse Hill. Other quantities of the manures, details of which are given below, were also tried. A third experiment, involving method of sowing, was also carried out on Mr. W. W. Mulholland's farm, at Darfield: this is discussed separately. The experiments are designated "A" (Mr. Symes's farm), "B" (Mr. Gunn's), and "C" (Mr. Mulholland's).

Experiments A and B.

The treatments applied on A and B were as follows:—

(1.) Superphosphate 42/44 per cent., 1 cwt. per acre.
(2.) Ephos phosphate, 1 cwt. per acre.
(3.) Super ½ cwt. plus Ephos ½ cwt. = 1 cwt. per acre.
(4.) Super 1 cwt. plus dried blood 1 cwt. = 2 cwt. per acre.

} Manures used in season 1924–25. The quantity per acre was reduced by ½ cwt. in the 1925–26 season.

(5.) Super, 2 cwt. per acre.
(6.) Super 1 cwt. plus Ephos 1 cwt. = 2 cwt. per acre.

Ten replications of the above series were sown in each case.

Super at 2 cwt. per acre was also tried, two applications of 1 cwt. each being made. The first application was made by running the drill over the plots with the coulters merely scratching the surface; the second application was applied immediately afterwards with the seed, as for the other plots. The object of this method of application was to supply the additional phosphate without the whole of it being in contact with the seed. The extra passage of horses and drill over these plots appears to have introduced a disturbing factor, and the germinations and yields are not discussed here.

In Experiments A and B the seed was sown through every coulter of the drill, giving 7 in. row spacing. Date sown: Experiment A, 21/10/25; Experiment B, 1/12/25. Seeding: 3 lb. per acre. Previous crops: Experiment A, 1924–25, turnips; 1921–24, grass. Experiment B, 1924–25, turnips; 1923–24 and 1922–23, wheat, preceded by grass.

RELATIVE EFFECTS OF MANURES ON GERMINATION.

Germination counts were made as described in the *Journal* for July last, p. 11, and the results of these are shown in Table 1.

Comments on Table 1.

Experiment A: Dry conditions at the time of sowing and for some time afterwards were experienced. The behaviour of Ephos as compared with super 1 cwt. per acre is difficult of interpretation. It is possible that the small quantity of super provided a certain stimulus

Table 1.—Relative Germination on Plots of Experiments A and B.

Treatment per Acre.	Experiment A. Counts taken 41 Days after Sowing.			Experiment B. Counts taken 38 Days after Sowing.	
	Number of Plants per 10 ft.*	Difference from Super 1 cwt. Plots.	Odds.	Number of Plants per 10 ft.*	Difference from Super 1 cwt. Plots.
Super 1 cwt.	28·6	..	..	23·2	None of the differences significant.
Ephos 1 cwt.	20·3	− 8·3	> 24000	23·4	
Super ½ cwt. plus Ephos ½ cwt. ..	27·3	*− 1·3*	..	25·5	
Super 1 cwt. plus blood 1 cwt. ..	15·4	− 13·2	> 24000	21·3	
Super 2 cwt.	17·5	− 11·1	> 24000	23·0	
Super 1 cwt. plus Ephos 1 cwt. ..	23·6	− 5·0	140	23·0	

* Mean of forty counts; the same coulter row was taken in each case. > = greater than (all tables).

NOTE.—Differences which have odds of less than 30 to 1 in their favour, and are therefore not statistically significant, are shown in italics. This applies to all tables.

which under dry conditions is lacking in the case of the less soluble Ephos. Only one control plot was sown, so this supposition could not be checked. It will be noticed that the larger quantity of super (2 cwt. per acre) has caused a definite depression, there being only about two-thirds the number of plants as compared with super 1 cwt. The addition of dried blood to super has reduced the number of plants by nearly 50 per cent. This action of blood on cruciferous seeds has been fairly consistent in these and other Canterbury experiments. Super plus Ephos at 2 cwt. per acre shows a slight depression in germination.

Experiment B: The plots of this experiment were sown as soon as the condition of the soil would permit after about ½ in. of rain had fallen. None of the plots differs to a significant degree from super 1 cwt. in germination effect. Super and blood again shows a tendency to a reduced germination, but the chances were only 13 to 1 in favour of significance.

YIELDS.

Experience of the previous season indicated that the growth of rape on Ephos-treated plots was rather prolonged as compared with that on those receiving super. It was decided, therefore, that portion of the whole of the plots would be cut and compared when the earlier-ripening ones were at the ideal stage for feeding off, and further cutting done when the later-maturing ones were ripe. The order of ripening was not the same as in the previous season. In Experiment A the Ephos plots were a little later in maturing than was the super 1 cwt. plot, but the more heavily treated phosphate plots hung out longer than any.

In Experiment B the Ephos plots ripened first, and at the time of the first cut were at an ideal feeding stage. The heavily phosphated plots again showed later ripening. Just after the first weighings were made a heavy rain fell, with the result that all plots became considerably greener again, and at the time of the second weighings, a fortnight after the first, they were all at about the same stage.

Table 2.—Yield Results, Experiment A.

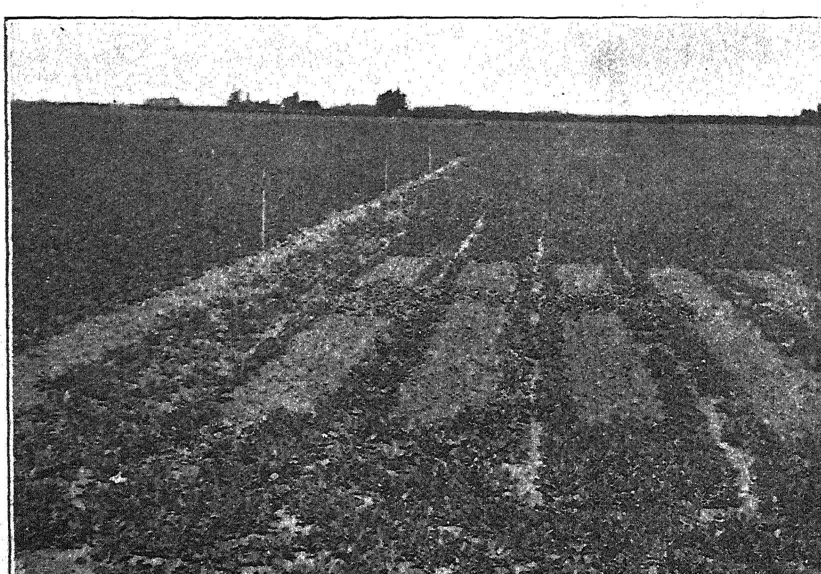
Area of individual weighed plot, $\frac{1}{453}$ acre.

Treatment.	First Weighing, 8/1/26, 11 Weeks 2 Days after Sowing.				Second Weighing, 22/1/26, 13 Weeks 2 Days after Sowing.			
	Number of Paired Plots.	Yield per Acre.	Increase (+) or Decrease (−) as compared with Super 1 cwt.	Odds.	Number of Paired Plots.	Yield per Acre.	Increase (+) or Decrease (−) as compared with Super 1 cwt.	Odds.
		Tons.	Tons.			Tons.	Tons.	
Super 1 cwt. ..	20	4·44	..	..	15	4·01	..	..
Ephos 1 cwt. ..	20	4·00	−0·44	>9999	15	3·57	−0·44	9999
Super ½ cwt. plus Ephos ½ cwt.	20	4·34	*−0·10*	10	15	3·97	*−0·04*	2
Super 1 cwt. plus dried blood 1 cwt.	20	4·49	*+0·05*	2	14*	4·00	*+0·05*	2
Super 2 cwt. ..	20	4·38	*−0·06*	3	15	3·99	*−0·02*	2
Super 1 cwt. ..	18	4·54	..	..	15	..	..	..
Super 1 cwt. plus Ephos 1 cwt.		4·74	*+0·20*	11		4·43	+0·42	140

* Mean of fourteen super plots with which super-plus-blood plots were compared, 3·95 tons per acre.

Comments on Table 2.

In the first weighing only the yield of the Ephos plots showed any significant difference from that of the super plots. The lower yields of the second weighing as compared with the first do not necessarily



TYPICAL PORTION OF PLOTS IN A POOR CROP (EXPERIMENT A).

To the right of the poles is an unsown strip with a control (unmanured) plot between it and the first cut plot.

[*Photo by A. W. Hudson.*

mean a definite reduction in yield due to overripening. The yields in the first weighing are computed from twenty determinations; those of the second from fifteen. The relationship of all is much the same in both cases, however. Here, again, super 1 cwt. is superior to Ephos. The 2-cwt.-per-acre application of super and Ephos is slightly superior to super 1 cwt., although in the first weighings the odds are not sufficiently great to enable the difference to be regarded with certainty.

Table 3.—Yield Results, Experiment B.

Area of individual weighed plot, $\frac{1}{433}$ acre.

Treatment.	First Weighing, 10/2/26, 10 Weeks 1 Day after Sowing.				Second Weighing, 23/2/26, 12 Weeks after Sowing.			
	Number of Paired Plots.	Yield per Acre.	Increase (+) or Decrease (−) as compared with Super 1 cwt.	Odds.	Number of Paired Plots.	Yield per Acre.	Increase (+) or Decrease (−) as compared with Super 1 cwt.	Odds.
		Tons.	Tons.			Tons.	Tons.	
Super 1 cwt. ..	12	5·05	..	..	10	5·57	..	..
Ephos 1 cwt. ..	12	3·94	−1·11	>9999	10	4·90	−0·67	1700
Super 1 cwt. plus blood 1 cwt.	12	6·32	+1·27	>9999	10	6·44	+0·87	>9999
Super 2 cwt. ..	12	6·93	+1·88	>9999	10	6·81	+1·24	>9999
Super 1 cwt. plus Ephos 1 cwt.	12	6·71	+1·66	>9999	10	6·89	+1·32	>9999
Super 1 cwt. ..	20	5·13	..	..	10	..	..	..
Super ½ cwt. plus Ephos ½ cwt.		4·79	−0·34	150		5·57	..	..

Comments on Table 3.

In both weighings the superiority of super over Ephos is considerable, being over 1 ton in the first and ⅔ ton in the second. Super plus blood, super 2 cwt., and super 1 cwt. plus Ephos 1 cwt. show decided increases over super 1 cwt. in both crops. The mixture of super and Ephos sown at the rate of 1 cwt. per acre is not as good as super 1 cwt. on the first weighing, but caught up to and equalled the super at the time of the second weighing.

Experiment C.

Date sown: 30/10/25. Seeding: 1¾ lb. per acre. Previous crop: Grass for three years. In this experiment the seed was sown in 14 in. rows—that is, through alternate coulters of the drill.

RELATIVE EFFECT OF MANURES ON GERMINATION.

The manures in some cases were sown in the seed rows only. In others they were sown through every coulter, so that half the manure fell on the seed rows and half between them. It was expected that with heavier sowings of superphosphate — say, 2 cwt. per acre — where the whole of the manure fell with the seed, considerable adverse effect on germination would result. The question was whether the manure could be better utilized by sowing through every coulter, in which case there would be less harm to the seed, and every chance of the established plants getting the benefit of the manure between

the rows as soon as their rooting-system was developed. Another form of nitrogenous fertilizer—sulphate of ammonia—was also tried. The results of the preceding season (see *Journal* for November, 1925, p. 308) showed that blood was having a beneficial effect on yield, and the possibility of better results from a more efficient form of nitrogen was considered worth testing. Consequently sulphate of ammonia at the rate of 67 lb. per acre (an amount containing about the same quantity of nitrogen as 1 cwt. of blood) was used.

The manures used and the manner of sowing are as follows:—

Super 1 cwt. per acre; manure in 7 in. rows.
Super 1 cwt. per acre; manure in 14 in. rows.
Super 2 cwt. per acre; manure in 7 in. rows.
Super 2 cwt. per acre; manure in 14 in. rows.
Super 1 cwt. plus dried blood 1 cwt. per acre; manure in 14 in. rows.
Super 1 cwt. plus sulphate of ammonia 67 lb. per acre; manure in 7 in. rows.
Super 1 cwt. plus sulphate of ammonia 67 lb. per acre; manure in 14 in. rows.

Ten replications of the above were sown.

The actual germinations as measured by the number of plants per 10 ft. of row are shown in Table 4.

Table 4.—Relative Germination on Plots of Experiment C.

Counts taken 33 days after sowing.

Treatment per Acre.	Spacing of Manure Rows.	Number of Plants per 10 ft.*	Difference in Favour of A.	Odds.
	Inches.			
A. Super 1 cwt.	7	25·8	4·0	35
B. Super 1 cwt.	14	21·8	..	..
A. Super 2 cwt.	7	16·7	6·0	>24000
B. Super 2 cwt.	14	10·7	..	..
A. Super 1 cwt.	14	21·8	8·1	>24000
B. Super 1 cwt. plus dried blood 1 cwt.	14	13·7	..	..
A. Super 1 cwt.	7	25·8	16·3	>24000
B. Super 1 cwt. plus sulphate of ammonia 67 lb.	7	9·5	..	..
A. Super 1 cwt.	14	21·8	18·6	>24000
B. Super 1 cwt. plus sulphate of ammonia 67 lb.	14	3·2	..	..

* Mean of forty counts.

Comments on Table 4.

(*a*.) It is evident from the table that considerable adverse effect on germination has resulted wherever a quantity of super greater than 1 cwt. per acre in rows at 7 in. spacing has been sown. The quantity of 2 cwt. per acre in 14 in. rows has caused a very serious reduction of about 36 per cent. as compared with the same quantity per acre in 7 in. rows. (*b*.) Blood in combination with super has caused a serious reduction as compared with straight-out super. (*c*.) The effect of the addition of sulphate of ammonia to superphosphate has been such

as to indicate that the sowing of the soluble nitrogenous manure with the seed is liable to cause too much damage to germination for it to be practised. In the 14 in. rows the germination was almost entirely ruined.

YIELDS.

At the time of first cutting the plots having the greater number of plants—namely, super 1 cwt. per acre—were somewhat riper than the remainder. The plots receiving nitrogen (blood or sulphate of ammonia) were deeper green in colour than any others, and at the time of the second cutting showed a blue tinge, indicating ripeness.

The results of the weighing are shown in Table 5.

Table 5.—Yield Results, Experiment C.

Number of paired plots from which differences are calculated, 20 in each case. Area of individual weighed plot, $\frac{1}{500}$ acre.

Treatment.	Spacing of Manure Rows.	First Weighing, 19/1/26, 11 Weeks 4 Days after Sowing. Yield per Acre.	Increase (+) or Decrease (−) compared with Super 1 cwt. in 14 in. Rows.	Odds.	Second Weighing, 4/2/26, 13 Weeks 6 Days after Sowing. Yield per Acre.	Increase (+) or Decrease (−) compared with Super 1 cwt. in 14 in. Rows.	Odds.
	Inches	Tons.	Tons.		Tons.	Tons.	
Super 1 cwt. ..	14	4·01	..	..	4·80	..	..
Super 1 cwt. ..	7	4·27	+0·26	22	4·95	+0·15	9
Super 2 cwt. ..	7	4·56	+0·55	1110	5·24	+0·44	30
Super 2 cwt. ..	14	4·01	..	..	4·69	−0·11	2
Super 1 cwt. plus blood 1 cwt.	14	4·78	+0·77	>9999	5·66	+0·86	>9999
Super 1 cwt. plus sulphate of ammonia 67 lb.	7	3·64	−0·37	46	4·03	−0·77	>9999
Super 1 cwt. plus sulphate of ammonia 67 lb.	14	2·15	−1·86	>9999	2·84	−1·96	>9999

Comments on Table 5.

Comparisons have been made between super 1 cwt. per acre in 14 in. rows and all other treatments, because it is standard practice to sow the whole of the manure in the seed rows irrespective of the width of row. (*a.*) Super 1 cwt., 7 in. rows, *versus* super 1 cwt., 14 in rows: Although a better germination resulted in the case of the former (see Table 4), the increase is not significant in either weighing. (*b.*) Super 2 cwt., 7 in. rows, *versus* super 1 cwt., 14 in. rows: The former shows an average increase over the latter of ½ ton per acre, although having fewer plants. (*c.*) Super 2 cwt., 14 in. rows, *versus* super 1 cwt., 14 in. rows: The reduction in the number of plants (see Table 4) due to the heavier sowing of super has apparently imposed too great a handicap, for, although the 2 cwt. quantity in 7 in. rows is superior to 1 cwt. in 14 in., the 2 cwt. quantity in 14 in. does not differ from the 1 cwt. by a significant amount. (*d.*) Super plus blood *versus* super 1 cwt., 14 in. rows: The reduction in number of plants (see Table 4) caused by the blood has not

prevented it from registering an increase of over $\frac{3}{4}$ ton in both weighings. (*e*.) The thinning due to the sulphate of ammonia has evidently been so severe as to limit its usefulness, and other methods of application must be tried.

General Conclusions.

(1.) The consistency with which 1 cwt. of super has proved its superiority over 1 cwt. of Ephos as a manure for rape is sufficient evidence for the recommendation of the use of the former. Further trial will be made in the current season, however.

(2.) There is not yet sufficient evidence to warrant the recommendation of the use of more than 1 cwt. of super per acre.

(3.) Nitrogen in the form of dried blood at 1 cwt. per acre added to super has, with the exception of Experiment B above, given decided increases in all experiments to date. Whether the increase caused is commensurate with the cost of the treatment can be decided only when a greater amount of data has been collected and a reliable estimate of the average increase arrived at. The damage to germination and consequent thinning of the crop may be a favourable factor, but it is more probable that the increase is due to the specific action of the blood as a plant-food. Some method of sowing aiming at the reduction of this adverse effect on the seed will be tried in the current season.

(4.) The amount of soil-moisture present is undoubtedly an important factor governing the effect on germination of soluble phosphates.

The Department's indebtedness to Messrs. J. Symes, R. S. Gunn, and W. W. Mulholland for their continued co-operation and interest is here recorded.

VITICULTURE AND WINE-MAKING.

THE annual report of the Horticulture Division for 1925–26 gives the following summarized information regarding the progress of viticulture and wine-making in the Dominion:—

The planting of vineyards, both in table and wine grapes, is steadily increasing. The season of 1925–26 was not favourable to the development of certain varieties of outdoor-grown table grapes, owing to the unsuitable weather conditions prevailing during the setting-period. The prices realized on the markets were, however, satisfactory to growers, especially in regard to the Albany Surprise variety. The crop of wine grapes equalled that of the previous year. In some localities where the weather was hardly warm enough during the ripening-period the sugar content of the grape-juice was low. Generally speaking, the vines were free of disease; this was particularly noticeable in the Hawke's Bay District, which experienced a particularly dry season. The quantity of grape-wine produced in the Dominion was approximately the same as last year—85,000 gallons, valued at £34,000. The co-operative vine-testing plots established in 1922 at Nelson and Te Mata are making satisfactory progress. In connection with the Nelson plot, the results obtained so far indicate the possibility of ripening grapes successfully outdoors in that district. Grape-growing under glass is gradually extending. The high prices ruling for glass and other materials during the past few years practically prohibited the erection of glasshouses. A gradual reduction in prices has, however, enabled development to take place, and several new vineries have recently been built. There is a good demand for hothouse-grown grapes, and the returns to growers have been satisfactory.

TRIALS OF ARTIFICIAL FARMYARD MANURE AT LINCOLN COLLEGE.

M. J. SCOTT, B.A., B.Sc., A.I.C., Canterbury Agricultural College, Lincoln.

FOLLOWING an unsuccessful trial of artificial farmyard manure (A.F.Y.M.) with mangolds in 1924–25, figures are now available from a repetition test in the past season. Owing to the wet winter of 1925 it was impossible to get the ground in order for sowing before 17th November. The mangolds were pulled on 17th June, 1926. The manure was applied at the rate of thirty-five loads, equivalent to 20 tons per acre, in August, 1925, but was not ploughed in until the end of September owing to the wet weather.

The plan of the experiment was as follows: Adjacent strips, 8 yards wide, running the whole length of the field, were manured with (1) A.F.Y.M., (2) bullock-dung, and (3) no dung. These were repeated across the field six times. At harvest six weighings were made in each strip off six consecutive chains in a row chosen at random, making thirty-six weighings in each trial.

The method of comparison used was that known as "Student's," which was explained by Dr. Hilgendorf in the January, 1925, issue of this *Journal*, the results being as follows:—

Manure.	Yield in Tons per Acre.	Increase per Cent.	Odds in Favour of Significance.
		Over Control.	
A.F.Y.M.	12·1	12·1	58 to 1
Control	10·8	..	..
Dung	11·67	16·7	170 to 1
Control	10·0	..	..
		Over Dung.	
Dung	10·3	..	..
A.F.Y.M.	10·4	1·0	>1 to 1

The low yields are extraordinary, and are probably due to the lateness of sowing and the condition of the ground. In an adjoining lea paddock, on a slight rise, the yield was 30 tons per acre. This paddock had been used as a right-of-way for stock for some years, and was tramped hard. It is suggested that on this account, and because it was higher, most of the rain ran off the surface, and the ground was never waterlogged. The other field had oats and tares on it; the soil was consequently very open, and waterlogging complete.

Wheat has now been sown, with a view to making further estimates of the effect of the treatments on yield.

NOTE.—For previous articles on this subject see *Journal*, February and October, 1925.

Blindness in Sheep.—This trouble (ophthalmia) was noted in some districts during the past year, particularly in the west-coast district of the South Island and in the Nelson and Wanganui districts. Further investigational work is being carried out at the Wallaceville Laboratory.

BLUE LUPINS AS WINTER FORAGE CROP FOR SHEEP.

EXPERIENCE IN MOTUEKA DISTRICT.

F. W. GREENWOOD, B.A., Instructor in Agriculture, Blenheim.

UNTIL quite recently in this country blue lupins were generally considered to be practically valueless as fodder for stock. The writer first became interested in the question of the edibility of this plant through observations made in connection with dairy cattle, which, although in abundance of feed in the flush of the year, forced their way through barbed wires and devoured with avidity blue lupins in stack ready to be threshed for seed. In the autumn of the same year, when the supply of grass was by no means short, cattle devoured a stack-butt of lupin-straw, hardly leaving a straw to mark the original site of the stack.

For several years past farmers on the Moutere Plains, in the Motueka district, have been wintering ewes and wethers on blue lupins. The ground in this locality is extremely light and stony. Prior to the introduction of the practice of feeding the lupins it was usual for the farmers to sow that crop early in February. It was then ploughed in about the end of July, and a crop of oats sown at the end of August, to be harvested for chaff in the following January or February. It is necessary to understand that if Algerian oats are sown in March, as in Marlborough, it is not possible to follow the Marlborough practice of grazing with sheep in May and August in order to encourage stooling, since the ground on the Moutere Plains is not sufficiently good in quality, even when a certain amount of manure (green or otherwise) is applied, to stand the double feeding and still produce a good crop of oats. The practice in the Motueka district now is to feed the lupins off during the winter, then plough in the stubble and the droppings of sheep. In this way a crop of oats yielding 2 tons of chaff per acre is produced, in comparison with a 1-ton crop from land neither treated in this way nor dressed with artificial fertilizers.

The experience of Mr. A. J. Jackett with the feeding-off of the blue-lupin crop by sheep is worth quoting. Mr. Jackett now holds that the blue-lupin and turnip crops form his main winter fodders for sheep. In June, 1925, three hundred breeding-ewes were turned on to 30 acres of lupins. The crop was fed off in two breaks, the sheep being first turned on to 14 acres and left for eleven days. While the sheep were on the lupins, turnips were also fed out to them. Now the practice is to graze them on the turnips, then turn them on to the lupins. In an 8½-acre paddock at Whakarewa two gates—one at each end of the paddock—were opened. One gate led into a grass-paddock and the other into a field of turnips. The sheep remained upon the lupin crop without troubling either the grass or the turnips until the lupins were eaten right down. When Mr. Jackett first started grazing his sheep on blue lupins two ewes slipped their lambs. There is, of course, no valid proof that this had anything to do with the lupin crop, as it might just as easily have occurred in a turnip or a pasture paddock.

FIG. 1. SHEEP FEEDING ON BLUE LUPINS IN AUGUST ON MR. JACKETT'S FARM, MOTUEKA.

FIG. 2. SHOWING STAGE AT WHICH THE LUPIN CROP IS UTILIZED FOR FEEDING OFF.
Light stony nature of soil is indicated in foreground.

Towards the end of August this year the writer saw on this farm stud Romney ewes, ordinary flock ewes, wethers, and rams all in splendid condition. Quite a number of these animals had been put on to lupins for the first time.

The correct stage at which to feed the blue lupin is either just before or just after flowering. Fig. 1 shows sheep which have come off a turnip-paddock feeding keenly in a lupin crop from 18 in. to 21 in. in height.

The writer does not contend that the lupin crop is one of the best for winter sheep-fodder. This is a matter that requires a good deal of further investigation. Without hesitation, however, he can say that in such a district as that of the Moutere Plains the blue lupin is proving itself a valuable winter fodder.

STRATFORD DEMONSTRATION FARM.

NOTES ON OPERATIONS, SEASON 1925-26.

J. W. DEEM, Instructor in Agriculture, and Chairman Stratford Demonstration Farm Society.

IN 1925-26 the work at the Stratford Demonstration Farm continued much on the lines of previous years. Most of the stumping has now been completed, and more time will be available for clearing up odd corners and tidying up the farm generally.

PASTURES.

These continue to do well, and it is very interesting to see how the better types of grasses, such as rye-grass and timothy, and clovers, are persisting and predominating where the top-dressing and grazing have been carried out under the best conditions. On the other hand, where the grazing has not been properly controlled there is a tendency for cocksfoot and the rougher type of grasses to gain the ascendancy. A good illustration of this is to be seen in Fields 4 and 5, the former having been grazed better than the latter. Another very fine comparison is to be seen in Field 12, where imported wild and colonial-grown clovers are being tested against ordinary imported white. The ordinary imported white has almost disappeared, and the pasture does not seem so palatable and is neglected by stock in comparison with the areas where the colonial and imported wild white are grown. The result is that where the latter clovers were sown the field is beautifully grazed, but where the ordinary imported white was sown there is a tendency for the rougher grasses to get possession. The permanency of imported wild and colonial white as against ordinary imported is very marked, and it is worthy of note that the same results are reported from the Gore Experimental Area in Southland, where a similar trial was laid down in the same year as the Stratford experiments (see *Journal* for July last).

Top-dressing.

Pasture top-dressing continues to give good results. The experiments have been extended to cover comparisons between basic slag and Nauru phosphate (Fields 4 and 5); slag and lime and super (Field 1); slag, basic super, and Rhenania phosphate (Field 3); slag, half super half Nauru, blood-and-bone, steamed bone, super, and lime and super (Fields 8 and 12); slag and basic super (Field 15). In addition to these phosphatic manures, potassic top-dressing with kainit, 30% potash, and sulphate of potash is being tested in Fields 4, 5, and 12.

As has been the case at this farm in former years, slag continues to give the best results. Lime and super and basic super are also doing well; while the Nauru areas in Fields 5 and 14 are giving very satisfactory results.

Areas in Fields 4 and 12 have been top-dressed for the past two years with kainit at the rate of 2 cwt. per acre. This top-dressing crosses several phosphatic dressings in Field 12 and slag in Field 4. So far there has not been any definitely noticeable improvement from

the addition of kainit, nor is there any indication of stock showing any preference for the kainit-treated areas. Field 4, which is getting slag at the rate of 3 cwt. per acre per year (half receiving 3 cwt. every year and half 6 cwt. every second year), is still in splendid condition and shows no sign of deterioration. The area that received the 6-cwt.-per-acre dressing last year was grazed rather better than the 3 cwt. area during the last season, but now that the latter area has been redressed it looks the better of the two. Taking the grazing right through the period there is not much difference, but the result is, if anything, slightly in favour of the annual dressing.

ROOT CROPS.

As usual, several new varieties of roots were tested against standard varieties. These consisted of seven varieties of turnips, seven of swedes, four of carrots, and four of mangolds. While some of them were quite good, in no case did any stand out superior to standard varieties. In turnips, Red Paragon, 46 tons 1 cwt., and Green Globe, 39 tons 14 cwt., per acre, again gave the best results. In swedes, Grandmaster, 35 tons 13 cwt., was best. In carrots, Matchless White, 49 tons 6 cwt., came first, with White Belgian, 47 tons 11 cwt., and Barriball, 43 tons 1 cwt., next. In mangolds, Prizewinner was best, with 55 tons 7 cwt.; Giant Orange Globe second, with 52 tons 11 cwt.; and White Knight third, with 51 tons 5 cwt. The average for all varieties was 51 tons 10 cwt. per acre, against 47 tons 8 cwt. in the preceding year.

The manure used for the main soft-turnip crop was 3 cwt. basic super per acre. There was also a manure test with three phosphatic manures as follows: Basic super, 3 cwt. per acre, yield 39 tons 14 cwt. per acre; two parts super and one part slag, 3 cwt. per acre, yield 43 tons 3 cwt.; two parts super and one part Nauru phosphate, 3 cwt. per acre, yield 41 tons 11 cwt. The crop looked even, and the difference in weight is not significant, being in the radius of probable error in weighing. Basic super, 3 cwt. per acre, was also used for the swede crop.

There was a fair amount of club-root in the swedes, but no appearance of dry-rot in any of the varieties. This is in keeping with the observations made while judging the district field competitions, when fifty-one swede crops were examined and weighed, and in only two instances was dry-rot found, one of these being a second crop grown after a badly affected one. This is gratifying, and it would appear as if the swede crop was to some extent coming back.

The manure used for the main mangold crop was three parts super, one part bonemeal, and one part Nauru phosphate, at the rate of 6 cwt. per acre, plus kainit 3 cwt. per acre. A manurial test was made, using the super, bonemeal, and Nauru in the proportions and weight mentioned above, which may be called mixture No. 1. The variety of mangold used was Prizewinner. The results were as follows:—

	Yield.		Cost for Manure per Ton of Roots.	
	Tons	cwt.	s.	d.
(*a.*) Mixture No. 1 plus 3 cwt. kainit per acre ..	55	7	1	$1\frac{3}{10}$
(*b.*) Mixture No. 1 plus 3 cwt. salt and 1 cwt. sulphate of potash per acre	55	6	1	$3\frac{9}{10}$
(*c.*) Mixture No. 1 plus 3 cwt. salt per acre	54	14	1	0
(*d.*) Mixture No. 1 plus 1 cwt. sulphate of potash per acre	51	5	1	$2\frac{2}{10}$

These results again emphasize the value of salt in the Stratford district, confirming the finding of previous years, which has shown that salt is better than sulphate of potash, and, in fact, that if salt is used potash may be discarded. It is also interesting to note that Mr. J. B. Hine's splendid crop of 111 tons of mangolds (in the farmers' field competitions for 1925–26) was grown with a dressing of 10 cwt. of salt per acre and no potash. Further, an analysis of the mangolds grown in Taranaki and weighed in connection with the competitions shows that eight crops that had salt applied to the land gave an average yield of 63 tons 2 cwt., while twenty-three crops that had potash in some form or other gave an average of 56 tons 2 cwt. The deduction is to use salt for mangolds, or a form of potassic top-dressing such as kainit or 30 per cent. potash, both of which contain large quantities of salt.

The manure used for carrots was super three parts, bonemeal one part, and Nauru phosphate one part, at the rate of 5 cwt. per acre. Carrots seem to do fairly well with most mixtures of manures, and for this reason it is frequently stated that it is not good practice to give carrots a heavy manuring. This is not borne out by the field competitions, which show that twenty-four crops receiving 4 cwt. of manure per acre averaged 43 tons 10 cwt. per acre, and eleven receiving 5 cwt. of manure averaged 53 tons 7 cwt. Position and variety would have some effect, but the figures are significant.

GREEN CROPS.

Oats and tares were again grown for hay and ensilage, the seeding being 2 bushels Algerian oats and 1 bushel Scotch tares. The area for ensilage was sown on 9th October and harvested during the first week in February. The manure used was basic super, 2 cwt. per acre. The green crop weighed approximately 12 tons per acre. This was made into stack silage.

Chou moellier was grown on land that had previously been cropped with swedes, and showed a wonderful resistance to club-root, although the swedes had been fairly bad with that disease. Sowing was done about the middle of November, and the crop was still in good feeding-condition on 15th August. Small areas were also grown for feeding pigs during winter. The results have been good for stores over three months old and for breeding-sows, but small pigs just weaned did not thrive on this crop. The special areas were finished by the end of July, but part of the main crops was being cut and fed in the middle of August, and the pigs continued to do well on it. Seeding was at the rate of 1 lb. per acre. Manure was 3 cwt. basic super, but 4 cwt. would be better.

WEED-CONTROL.

When taken over, most of this farm was badly infested with ragwort, blackberry, and ox-eye daisy. The system of cultivation followed practically cleans these weeds out in two years. The land is stumped, ploughed, and sown in root crops, mostly soft turnips and swedes. Then, as these are fed off, the land is reploughed and sown in oats, or oats and tares, or peas. As soon as these are harvested the land is again ploughed, and another crop of oats, or oats and tares, is sown

—oats and tares for preference. The object is to get two smother-crops in the one year; and if the second ploughing and sowing take place some time in February or early in March weeds have no chance of seeding, and blackberry gets knocked about before it has a chance to re-establish. Heavy crops are required for smothering, and the manuring should therefore be liberal; 2 cwt. basic super or super per acre is used at this farm.

Swedes are one of the worst crops for controlling blackberry, owing to the length of time they are in the ground. On the other hand, they are a very useful crop on new land, and most farmers will prefer to grow them and do the smothering the following year.

DAIRY HERD.

The herd continues to do well. The total butterfat for the year under review, taken from the factory returns, shows an increase of 3·2 lb. per cow and 8·15 lb. per acre. When the exceptionally rough weather experienced last season is taken into consideration this increase is very satisfactory. The following table, showing the butterfat produced per cow and per acre for the last seven years, is interesting. The area of the farm is 143 acres.

Year.	Butterfat per Cow.	Butterfat per Acre.	Total Butterfat.
	lb.	lb.	lb.
1919–20	221·10	60·80	8,694
1920–21	274·27	88·70	12,684
1921–22	298·90	104·50	14,943
1922–23	280·00	98·60	14,099
1923–24	305·00	108·90	15,572
1924–25	327·30	121·30	17,345
1925–26	330·50	129·45	18,514

A very large amount of the above-noted increase is due to top-dressing, and it will be of interest to note that the expenditure this year on manures works out at 14s. 3d. per acre, against 15s. 6d. last year.

GENERAL.

The financial position of the society shows steady improvement, the liabilities having been reduced during the year by £495 11s. 9d.

Farmers continue to visit the farm in large numbers, particularly on special field days.

As mentioned in last year's notes, Mr. W. J. Grierson was appointed farm-manager in July, 1925. During the past season he has carried out his duties in a very efficient manner, as is evidenced by the good returns.

Registration and Inspection of Nurseries.—During 1925–26 a total of 593 nurseries were registered by the Horticulture Division, and £593 collected in registration fees. A fair number of the registrations made apply to persons raising tomato-plants for sale. The Division reports that the bulk of the nurseries were in a clean condition, and no trouble was experienced in carrying out the requirements of the regulations.

SEASONAL NOTES.

THE FARM.

ESTABLISHMENT OF LUCERNE.

NOVEMBER is a favourable month in most districts for sowing lucerne if the land is clean. The ground should be kept constantly stirred right up to the time of sowing, in order to germinate and destroy any weeds. Every precaution should be taken to give the stand a good start, and nothing left to chance. Consequently the ground should be inoculated, unless it is known for certain that this can be dispensed with. The distribution of soil from a vigorous, well-established lucerne plot, at the rate of 3 cwt. to 4 cwt. per acre, should be carried out on a dull day, or in the evening, and the ground well harrowed. If inoculated soil cannot be economically obtained the proprietary culture known as Farmogerm may be used on the seed. The culture method gives fairly good results, but hardly the same satisfaction as soil-inoculation. The land should have been previously limed with at least 10 cwt. of carbonate of lime, or 5 cwt. of burnt lime, but these quantities can be advantageously increased.

A firm and fine seed-bed is necessary, and the seed should not be buried too deeply. A good sample of seed is an important consideration; a good, bright, fresh sample will amply repay any extra expenditure involved, and an old sample should be avoided. On the lighter classes of soil the seed-bed is best finished off with a heavy Cambridge roller, and the seed broadcast at the rate of 15 lb. or 16 lb. per acre, and covered with a light harrowing with the brush harrows. The ground should then be again rolled. On heavier soils the seed may be lightly drilled in 7 in. drills at the same rate of seeding, and lightly covered, but not rolled afterwards. It is good practice to drill half the seed one way and then cross-drill the other half. Where the wide-row method is being followed 10 lb. of seed per acre will be sufficient for 14 in. and 8 lb. for 21 in. rows.

A suitable fertilizer for lucerne - establishment is superphosphate, at 2 cwt. to 3 cwt. per acre, and the addition of ½ cwt of sulphate of potash will generally be found beneficial.

THE RAPE AND TURNIP CROPS.

Land in preparation for late November and December rape crops should be kept well stirred and free from weeds. Speaking generally, the main crop—one of the most important on sheep-farms—will be sown in November. It is often asked whether this fine forage plant can be safely utilized by dairy-farmers. Although rape is admittedly a bad milk-tainter, yet, fed with discretion to the dairy herd, it has been found possible to avoid this trouble and obtain high yields of butterfat. A mixture of peas and oats with rape is preferable, however. Just as the dairy-farmer has learned to feed soft turnips with discretion, he may also learn to feed rape.

Italian or Western Wolths rye-grass for temporary pasture can be sown with rape. The inclusion of 5 lb. to 7 lb. per acre of Western Wolths will be found beneficial for lambs feeding off the crop.

The sowing of hard turnips will demand attention during the coming month. In certain districts, however — of Canterbury in particular—where the grass-grub beetle is prevalent, there is a danger that the strike may be badly affected. In such cases the sowing of the main crop had better be left until about Christmas-time. The majority of the beetles are on the wing from mid-November to mid-December, and sowings of turnips and swedes, also rape, should be arranged accordingly.

MAIZE AND MILLET FOR GREEN FORAGE.

Maize and millet may be sown when danger from frost is past. These are both good crops for the dairy herd during dry autumn weather. Maize for green feed should be sown at the rate of 30 lb. to 60 lb. per acre in 28 in. drills, or broadcast at the rate of 1½ to 2 bushels per acre. Drilling is preferable, as it allows for intercultivation, which ensures a heavier yield under dry conditions. Among suitable varieties are Hickory King and Ninety Day. The seed should be sown at least 1½ in. deep, and guarded as far as possible against birds.

Japanese millet should not be sown too early—any time after the middle of November in the warmer districts, and the first week in December in colder situations. It does well when combined with red or crimson clover. By itself, 15 lb. to 20 lb. of seed per acre in 7 in. drills, or 10 lb. of millet with 8 lb. of clover, may be sown.

Superphosphate, at the rate of 2 cwt. to 3 cwt. per acre, makes a good fertilizer for these two crops on average soils.

CONTROL OF GRASS-GRUB.

Although no effective means of complete control of this pest is known, with good farm-management the destruction caused by the grubs can be greatly lessened. The ravages of the grub are periodic—assuming destructive proportions when a large increase in the number of grubs present coincides with dry-weather conditions. On moist soils often no injury may be apparent, while the grass on poor, dry soils, with an equal number of grubs, is completely killed. Rye-grass suffers more than cocksfoot, while crested dogstail and clovers are rarely attacked. Danthonia is able to survive attack, and on hill country subject to periodic visitations of the grub this grass should always be included in the pasture mixture.

With a really badly infested pasture on ploughable land almost the only procedure to adopt is to plough it up for a spring-sown forage crop. Rape is a particularly good crop for this purpose. The cultivation in October helps to kill the pupæ, and the ground is bare when the beetles are laying their eggs. Grass can be sown after the rape with every chance of success. On dairy farms soft turnips would be the best crop to grow. On a field not badly affected heavy stocking helps to improve the grass left, and this, together with top-dressing, will help the grass to recover.

MISCELLANEOUS.

Many farmers have been doing a certain amount of experimentation in pasture top-dressing with different fertilizers, and the present is a good time to note results. Great care should be taken to examine the quality as well as the quantity of the grass. It requires to be fully recognized that a given weight of a good mixture containing plenty of clovers will have a much greater feeding-value than double the quantity of rough grass. It is also important to note the manure that gives a good steady return throughout the season, as against the one that induces a rush of herbage at first but does not have a lasting effect.

Last season tarweed was very prevalent on pastures in certain Northern districts, and many plants were allowed to seed. In cases of bad infestation the plants should be cut off before seeding by running the mower over the area. Sweet vernal is another weed of pasture land which if mown early before seeding takes place will in time be suppressed. This grass gives a distinct taint to the milk when cows have been grazing on it, and it is one of the earliest grasses to flower.

Where weeds are germinating freely on the ridges of a newly planted potato crop considerable labour may be avoided by a stroke of the tine harrows laid on their back and pulled lengthwise along the ridges. This kills the small seedling weeds and at the same time breaks down the ridges, allowing the sprouts of the tubers to reach the surface more easily.

Established lucerne stands will provide their first cut during the coming month. If not required for green fodder this cut is best made into ensilage.

All implements connected with the operations of haying and ensiling should now be attended to, in order to avoid any delay during the rush of those operations.

—*Fields Division.*

THE ORCHARD.

CULTIVATION AND FERTILIZERS.

It is important that cultivation of the orchards should continue to receive special attention. The ground should be worked down to a fine tilth and kept well stirred to a depth of from 3 in. to 4 in. so as to conserve the soil-moisture and allow free access of air into the soil. To maintain the full benefit of cultivation the formation of a crust, when the land dries sufficiently after rains, should be prevented by stirring the soil immediately it is dry enough to work. Ploughing in the orchard at this time of year is not recommended, as this deeper cultivation will seriously disturb and destroy many of the feeding-roots, which will cause a considerable reduction in the food-supply of the trees at a vital period of their life—that of fruit-setting and stoning. In localities where spring ploughing has not yet been completed owing to the condition of the soil or other circumstances

every endeavour should be made to have it finished as soon as possible, and preferably at a reduced depth.

Growers who intend to make an application of nitrates during the spring to the orchard soil should do so now and during the coming month.

SPRAYING.

Spraying for pests and diseases should be along the lines set out in the orchard notes published in the August *Journal*. The cold wet weather recently experienced throughout the Dominion was favourable to the development of fungi, and in particular black-spot and brown-rot. Growers are urged to make the necessary sprayings at the periods mentioned, and to do the work thoroughly, covering the whole surface of the tree and the fruit with a protective film of spray. It should be remembered that it is just as important to spray the under-side as it is the upper surface. Diseased laterals and twigs should be removed and destroyed. To obtain the best results in the control of apple-leaf hopper it is important that the spray should be applied when the insects are in the nymph form.

DISBUDDING, ETC.

Trees planted during the winter will now be starting into growth, and they should be carefully gone over and only three or four good shoots left about 3 in. or 4 in. apart on the trunk of the young trees. No two or more shoots should be allowed to start from the same point. On two-year-old and older trees planted this season shoots likely to interfere with the proper development of the leaders should be suppressed.

If stocks on which buds have been worked have not already been cut back, this should be done at once so as to encourage a straight trunk or branch. The cut should be slanting, and slightly lower on the side opposite the butt of the bud. In windy situations the shoots should be tied to and supported by stakes driven firmly into the ground, to prevent them being broken off before they become properly established.

Grafts should be examined, and where necessary the ties around the scions loosened so as to prevent the material cutting into them as they swell. Rewax the grafts where required. Pinch back the shoots arising from the stock, except those arising from a suitable position for budding should any of the grafts fail to take. Later in the season, if not required, they also should be pinched back. In exposed situations the scion growths should be tied to protect them from damage by wind. To do this, tie a stake firmly to each branch grafted, and then tie the growths to the stakes.

FRUIT-CASE TIMBER.

As soon as possible after the trees have set their crop an estimate of the number of cases required should be made, and the order placed for early delivery of the shooks so that they may be on hand and dry when required for use.

THINNING OF FRUIT.

One of the many questions that is exercising the minds of the leaders of the industry at the present time is the matter of keeping inferior fruit off the markets. The best way of solving this problem is for growers not to grow inferior and poor-quality fruit. It should be the endeavour of every orchardist to produce a better and higher-quality fruit, and not be a question of how many apples a tree can be made to produce. As a rule, trees will set and mature from two to four times as many fruits as they should be allowed to do, and if the crop is not thinned sufficiently according to the vigour of the trees there will be a large proportion of inferior fruit and a very small percentage of Fancy grade. Those growers who thin their crops regularly will substantiate the statement that there is more money in an average crop of Fancy grade than there is in a heavy crop of small, inferior fruit.

The thinning of sufficient of the fruit at an early stage in its growth is profitable to the grower for the following reasons: (1) Average size of fruit remaining is increased; (2) fruit is more uniform in size and shape; (3) better-coloured fruits are obtained; (4) fruits are improved in quality; (5) less diseased fruits are obtained, because affected fruits would be removed in the thinning; (6) the load of fruit is more evenly distributed over the tree, and this prevents the breaking of branches; (7) it removes misshapen fruits; (8) prevents premature dropping in certain varieties; (9) encourages regular bearing; (10) cost of picking is reduced; (11) less fertility is removed from the soil; (12) maintains the vigour of the trees.

To set rules for thinning is very difficult, as so much depends upon the variety, age of tree and its vitality, soil, cultivation, and climate. Unhealthy or diseased trees should not be expected to mature as much fruit as those which are healthy. The actual operation varies greatly with different fruits. Some growers use a special pair of thinning-shears, while others use their fingers for taking off the fruits. The thinner should go over the tree systematically, limb by limb; method in this work saves much time. Commence by removing diseased, undersized, and blemished fruits, and then thin out to a uniform distance apart. Stone-fruits should be thinned until they are so spaced that no two fruits will touch each other when mature. Thinning should commence as soon as the natural dropping of imperfect fruits, which occurs when the permanent fruits are setting, is over, and when there is no further danger of late spring frosts. Thinning should not be left until the fruit is large, as much of the benefit to be derived from thinning will then be lost.

—*W. K. Dallas, Orchard Instructor, Dunedin.*

Citrus-culture.

The profitable sale of locally grown lemons is very much affected by the undue amount of low-grade fruit produced. A ready market can usually be found for fruit of good quality, and it is in the interests of the individual in particular and the industry in general that more effort be made to eliminate the low-grade product. Examination of this poor-quality fruit shows that the main causes of inferiority are appearance and lack of keeping-quality.

As regards appearance, the chief defect is roughness caused mainly by verrucosis and coarseness of tree maturity. Verrucosis can be controlled, but only by continuous and methodical spraying. Bordeaux, 4-4-40, is the spray to be most relied upon, but to be fully effective it must be applied as soon as the flower-petals fall and expose the young fruit, which must be periodically covered with spray as development takes place. The lemon-tree, flowering as it does over an extended period, has a constant succession of young fruits. There is, of course, a decided main crop according to variety, to which spray attention is generally given, but much of the verrucosis blemish is developed on the fruits which arise from flowers out of season, and only when a continuity of spraying is done can the maximum of clean fruit be expected. A further detriment to appearance is the lack of clearness of skin, and often a sticky and sooty deposit resulting from the trees being infected with scale insects. Scales on the fruit at once brand it as unmarketable; but a scale infestation on the tree likewise causes blemished fruit, and unless steps are taken to fully control scale insects much fruit of low-grade appearance will be produced. Washing the fruit is at best an unsatisfactory method of overcoming the disfigurement; washed fruit always lacks brightness, and the rind is generally damaged in the process. A spring and autumn application of oil, 1-40, should be made to all trees, but applied when the trees are in active growth to minimize premature leaf-fall.

The coarseness of tree maturity is mainly brought about by allowing the fruit to hang, to become tree-ripe. When fruit is allowed to ripen on the tree not only does the rind become coarse, but the useless pithy part develops to excess. Unfavourable market conditions is the usual excuse given for allowing fruit to hang, but a more easily marketed product would have finally resulted had the fruit been picked when a $2\frac{1}{2}$ in. diameter was attained and cured or even matured off the tree, while at the same time the tree would have been released from the drain of maturing fruit. The keeping-quality of tree-ripened fruit is never good, and no process of curing can make it so; but the keeping-quality of timely harvested lemons can be more fully assured by closer attention to picking and handling so as to avoid all skin punctures.

Under no circumstances should fruit be pulled from the tree, but clippers used. There are several reliable makes of cutters to be had from any reliable ironmonger at a very nominal cost. These are designed with rounded points, and, properly used, will not puncture the fruit. Secateurs are sometimes used, but except in the hands of a most painstaking picker they will ruin a large number of fruits at picking-time. A portion of the stem should be left on the picked fruit, but as short a portion as possible and cut at right angles, not tapering to a point. Long stems left on are the cause of much of the punctured fruit found at present, no doubt by contact in picking-bags or orchard cases.

In all subsequent handlings and transport, handling should be most carefully done, as though bruises may not show to any extent they are most prejudicial to the keeping of lemons.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

MANAGEMENT POINTS.

WITH the present high cost of foodstuffs the poultry-keeper cannot afford to neglect any detail in regard to the feeding and general management of the flock. He should not try to rear weakly chickens; it never pays to rear birds lacking in vigour.

With the approach of hot weather, more than at any other time, constant warfare must be made against vermin. Do not think that because vermin cannot be seen in the house during the day they are not there. Some of the most dangerous parasitic pests of the fowl work at night and hide themselves during the day. The wise poultry-keeper never waits for vermin to appear. He realizes that prevention is better than cure, and sees that the quarters are maintained in a thorough sanitary state, and that every crack and crevice is frequently sprayed with a strong disinfectant.

The red mite (one of the worst enemies of the fowl) usually first makes its appearances surrounding the perches. It hides under the latter during the day, and attacks the birds at night by blood-sucking. For this reason the perches should be arranged in such a way that they are easily removable, so that every part can be got at by some vermin-exterminator. A good mixture for this purpose is equal parts of kerosene and raw linseed-oil. The mixture should be applied frequently with a brush or a cloth.

Perches should be arranged in such a way that they, or the feathers of the birds, do not touch the walls of the house. They should be fixed in gas-pipes or suspended by wires well away from the walls. In this way, if there are vermin in the walls of the house, they will be prevented to a great extent from getting on to the birds when roosting.

Profits will be reduced by not placing in the broody-coop birds showing the least sign of becoming broody. It should be remembered that the longer the bird is allowed to sit on the nest the longer will it take her to lose the sitting desire and resume egg-laying.

It is important in summer-time that fowls and ducks of all ages be provided with plenty of shade from hot sun.

Much will be lost, but nothing will be gained, by not having a system of toe-marking as a means of ascertaining the different ages and strains of birds when the next season for culling and mating of stock comes round. Neglect to have a distinguishing-mark as an indication of age-determination is responsible for many a good young hen being culled out and old birds retained on the plant. A punch suitable for marking chickens can be obtained at a cost of 2s.

Separate the sexes as early as possible, and market all surplus cockerels when they attain an age of four and a half to five months old. If the most money is to be made out of a cockerel it must be marketed before it commences to produce its adult feathers. Another advantage in marketing cockerels at an early age is that more space is available for the growing pullets.

Do not on any account neglect the growing pullets, or the cockerels intended for future breeding purposes. Wherever possible they should

be placed on clean, fresh ground, and fed and managed to the best advantage. It must be borne in mind that the treatment a bird receives during the growing stage has an important influence throughout its life.

FEEDING ACCORDING TO APPETITE.

Inquiries frequently reach me as to the exact amount of food that should be supplied daily to a given number of birds. This is a question that cannot be answered with any degree of satisfaction, for the one and only safe course is to feed according to the birds' appetite. The rule of weight or measure cannot be fixed, because the birds do not eat the same amount of food each day or at each meal. Their appetites vary according to the season of the year, and whether they are in a laying-condition or not. Obviously, as egg-laying increases the bird will demand a greater food-supply, because it is impossible to get something for nothing.

A half-starved bird is never profitable. There is no danger of overfeeding the heavy layer with the right class of food, provided she is given an opportunity of taking plenty of exercise. The foolish policy so often advocated of keeping fowls on the hungry side with the idea of preventing them from becoming too fat does not hold good where the high-class layer is concerned. It is safe to say that there are more unprofitable flocks to-day due to underfeeding than from any other one cause. Even if food-prices are high, the hen of the right laying-type will return a good profit over her keep.

Many complaints reach me of birds not laying up to the expectation of their owners. This in most cases is due either to underfeeding or the supplying of a food which the birds do not relish. Not only should the food be appetizing, but it must be of sound quality—food capable, after the bodily wants of the bird have been supplied, of enabling eggs to be made from it. Economy in all things connected with the management of poultry should always be kept in view, but the short-sighted policy of stinting the heavy layer of food it will eat is much to be deprecated. Of course, the poor layer or a bird past its most profitable period can be overfed, and these birds will soon declare the fact by developing an overfat condition. This is because they (the poor layers) convert their food into bodily fat, while the heavy layers convert theirs into eggs. The remark is often made, "I think my hens are too fat to lay." In most cases it is not that they are too fat to lay, but rather that they are not concerned in egg-production. Obviously, the keen poultry-keeper would not retain such birds.

The only way of reducing the food bill is to provide an abundance of green feed, which the majority of poultry - keepers can produce themselves. In this connection few realize the value of lucerne as an all-the-year-round food for poultry. If cut in its succulent stage and finely chaffed it provides an ideal green food for birds of all ages when fed in troughs during the day. Well-cured lucerne hay chaffed and steamed overnight will also be found a valuable bulking-material for the morning mash during the off season. It may also be fed to advantage in troughs to birds of all ages. Red clover is also an ideal food to grow for poultry, and may be fed in a similar manner to lucerne.

AN OVARIAN TROUBLE AND THE USE OF MILK.

A correspondent asks for advice as to the cause of several of his birds becoming affected with protrusion of the oviduct. He says that the flock have free range, and are given a mash of pollard and bran for the morning meal, to which meat-meal is included three times a week; for the evening meal wheat is provided. The morning mash is moistened with milk, and, in addition, milk is given in good quantities to drink.

In this case the answer is a simple one—meat-meal is not required at all. The birds, having free range, will pick up sufficient animal life such as worms, &c., to keep them in good laying form, without being provided with such a concentrated forcing diet as meat-meal. To secure a maximum yield of eggs in the late autumn and winter months a heavy meat ration is necessary, but at this period of the year — the natural breeding season for bird-life — it is only courting disaster to overforce birds with stimulating foods. Where milk is available, and especially where birds have free range, no other forcing-food is required for the maintenance of a profitable egg-yield. It should be remembered that milk not only serves as a drink but is a rich food as well. Indeed, the oversupply of milk may easily bring about ovarian troubles such as protrusion of the oviduct and the production of shell-less and double-yolked eggs. The most common mistake made is to compel the laying bird to drink a large quantity of milk merely for the purpose of quenching its thirst. Water in addition to the milk should always be available, so that the bird is not forced to take more of the latter than is good for it.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

LOCATING AN APIARY.

PERHAPS there is no more important question to the beekeeper than location. Upon his ability to select a suitable district in which to start beekeeping will depend his future success. There are few districts in the Dominion where bees cannot be kept in small numbers, but successful establishment of a commercial apiary will largely depend upon knowledge of the nectar-secreting plants. It is generally recognized that the main nectar-flow in New Zealand is produced from white clover and catsear, but it will be found to be a distinct advantage if the apiary is established in a district near patches of native bush or where the golden willow is abundant. Most of the indigenous trees and willows flower early, and the nectar from these sources is very valuable, as it provides ample stores in the spring.

In districts where dependence has to be placed entirely upon white clover a careful watch must be kept on the stores, and very often artificial feeding has to be resorted to in the spring and carried on until the appearance of the clover-bloom. This is often expensive, and can be usually avoided by selecting a site where at least a moderate spring flow may be anticipated. The rich dairy pastures of both the North and the South Island, and localities where cattle-raising is

carried on extensively, provide suitable sites for commercial apiaries. Country which is used for sheep-grazing is not profitable, as the clover pasture is usually eaten bare. Instances have come under my notice where abnormal crops have been secured in purely sheep-country, but they are too infrequent to be taken into consideration, and consequently this class of country should be avoided. Essentially the main requirements are feed and shelter, and if the apiarist is fortunate enough to locate his bees in a position where there is an abundant supply of nectar-secreting plants good shelter can be easily provided.

WATER.

In the absence of a natural supply, water should be provided. Bees require a good deal of water for brood-rearing throughout the whole season, and it often happens that numbers are lost if water is not close at hand. Moreover, bees often become a nuisance at cattle-troughs and by congregating round domestic supplies. Where a large number of colonies are kept it is imperative to see that the bees are well supplied. Many contrivances are used. "Simplicity" feeders make excellent vessels for containing water, but they require to be filled frequently and be occasionally cleansed. Bees prefer to take water from damp situations, and they may often be noticed in numbers sucking water from the ground where there has been any overflow. Feeders should be placed in a sheltered spot in the apiary.

ARTIFICIAL INCREASE.

Artificial increase may be accomplished in several ways, but perhaps the most satisfactory is by means of nuclei and division. A nucleus is best formed of two frames of emerging brood and young bees, one frame of honey, and one containing pollen. This must be completed by a virgin queen or a ripe cell. The nuclei may be utilized throughout the season for the mating of queens for renewal, and at the end of the summer, if two or more are united, or if each one is reinforced by the addition of bees and brood from strong colonies, they may be wintered in safety and will form good stocks for the next season. No surplus can be expected from them the year of their installation.

In dividing it is best to wait till the colony is preparing to swarm and ripe queen-cells appear in the hive. The hive can then simply be split in two by putting half the bees and brood on another stand, taking care to leave queen-cells in each division, and for preference putting as much emerging brood in the half which is to be placed in a new position. This latter precaution is necessary in order to make up the wastage from the field-bees that will return to the old stand. Each hive can then be completed by filling the vacancies by drawn-out combs. The queen-cells in the queenless half will be nursed by the young bees, while those in the half containing the queen will be torn down by the bees when they find the hive depleted. If the apiarist wants to be quite sure of this being done he may search for the queen and remove her while the division is being made, afterwards putting her in the hive on the new stand. The division method is advocated on account of its simplicity and the fact that there is no necessity for finding the queen before the operation. It is a most effectual preventive of swarming, and saves a great deal of trouble where increase is desired.

SUPERING.

In most districts November is early enough for the employment of supers, though much depends on weather conditions. If the weather is warm, the hives full of bees, and nectar coming in freely, the supers may now be added at any time. However, it is of no use discouraging the bees by giving additional space before the weather is warm enough to justify it. If increase is required it is as well to confine the bees to one story till the hive is overflowing with bees. This is almost certain to produce a desire to swarm, and the hive can then either be allowed to swarm naturally or be divided artificially. When the first super is put on it is best, if possible, to fill it entirely or partially with drawn-out combs. If only foundation is available, one or two combs—not containing brood—may be removed from the bottom story to the top, and sheets of foundation put in their place. On no account disturb the brood until settled weather eventuates. If foundation is used in the super, queen-excluders should not be used, as the bees will rarely travel through the excluders to work the foundation, and will usually swarm. Do not bring excluders into use until the bees are quite accustomed to working in the supers.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

TOBACCO GROWING.

IN the spring of last year when the tobacco-plants were all out in the field there was serious loss in many crops due to cut-worms, a popular name given to the larvæ of many different moths which live in the soil and feed on the young plants at night. Their destructive habit of eating the young plants off at the surface of the ground is sometimes sufficiently extensive to cause serious loss. The trouble is worse where the land has had only a brief preparation, as with longer fallow and more cultivation they have not the same opportunity to become established, and numbers are destroyed by birds. In the case of bad attacks the poison bait described in last month's notes may be used.

The shallow-rooting habit of the tobacco-plant demands careful cultivation at the present time, but care must be taken to maintain a fine tilth and destroy all weeds before they attain any size. If this is done now the expensive hand hoeing necessary when the plants are larger may be reduced to a minimum. During fine weather after rain is a particularly suitable occasion for this cultivation work if the land is sufficiently dry.

Of other dangers in the field high winds and hailstorms are the worst. In many instances it is worth while planting a high-growing crop of some kind alongside as a protection from prevailing winds, so important is it that the leaves should be well grown and free from bruising and torn edges that prevent a full maturity and development of a suitable texture.

THE TOMATO CROP.

On the main tomato crop under glass the lower bunches will now be ripening, and the plants will be well up the strings on which they are trained. This mass of foliage and the increasing sun-heat make it necessary to give careful consideration to ventilation if the plants are to be kept healthy and hardy and a suitable dry atmosphere is to be maintained. This attention is specially necessary in the early morning of fine hot days. About the time of the first picking—which usually takes place towards the end of November—it is customary to trim off and carry out the lower leaves that shade the ripening bunch, and on well-drained soils that are likely to become overdry a straw mulch of stable litter is now applied. The forcing manures that have been carefully avoided previously may, now that a number of fruit branches have set, be applied from time to time in a liquid form to help the swelling bunches.

Planting the outside tomato crop is done in most districts at about this period. A good bordeaux spray is often suitable treatment for the young plants before they are removed from the boxes. It not only prevents fungous disease, but is a considerable deterrent to insect pests by making the growth unpalatable. Carefully scrutinize each plant before putting it out, discarding those that are blind or untrue to type, soft, or stunted. The early paying crops can be obtained only by setting out good plants at the proper stage of growth. Plant them firmly and rather deep.

BERRY FRUITS.

The strawberry and gooseberry harvest will begin very shortly. Regarding the former, it is opportune to mention the need of picking the fruit when plants are free from surface moisture. Pick the fruit with a short stem attached, and let the picker carry a set of punnets and grade the fruit as it is picked. Avoid topping up with selected fruits—it is illegal. Fill the punnets and place them in a cool shady place while awaiting shipment.

Plantations of loganberries and raspberries will now be growing new canes. Those required for next season's fruiting will be all the stronger if the weak and badly placed new growths are removed now.

VEGETABLES AND POTATOES.

For winter supplies sow now late brocolli, savoys, and kale; or in the warmer districts sow the autumn and hardier cauliflowers in the place of broccoli, as they have the advantage of a much earlier maturity. Make these beds on good, moist land, and sow them thinly. In no class of vegetable-seeds is there such a wide range of quality as in the above mentioned. Needless to say, the best results can only be obtained by using first-class seed-strains. Asparagus-beds must not be allowed to become dry at this season. An ounce of nitrate of soda to each 4 gallons of water is an excellent stimulant now for this crop. Carefully inspect the early potato crop when in flower, and mark down sufficient of the best plants for seed tubers.

—*W. C. Hyde, Horticulturist.*

TESTING OF PUREBRED DAIRY COWS.

AUGUST-SEPTEMBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

THE appended list comprises particulars of performance of those cows which received certificates during August and September.

A NEW JERSEY CLASS-LEADER.

The outstanding performance recorded is undoubtedly that of the senior two-year-old Jersey, Ivondale Golden Rainbow, whose certificated yield of 768·46 lb. butterfat places her at the head of her class for the breed, her production exceeding that of the previous class-leader—Mr. W. J. Chynoweth's Marshland's Stylish Princess—by the good margin of 52·71 lb. fat.

Ivondale Golden Rainbow was bred and tested by Mr. P. J. Petersen, of Brixton, near Waitara. She commenced her test at the age of 2 years 311 days, and the period between her date of calving for commencement of test and date of calving subsequent to test was 433 days. She was milked only twice daily during the whole of her lactation period. One of the conspicuous features of her performance was the manner in which her yield was maintained throughout the whole of the test. Her highest monthly yield was for her first full month (a thirty-one-day month), in which she gave 71·95 lb. fat from 1,177·7 lb. milk. For the last month of her test (thirty days) she is credited with 58·42 lb. fat from 890·6 lb. milk. Her lowest individual test was 5·60 per cent., and her highest 6·56 per cent., her average test for the season being 5·92 per cent. She also has a C.O.R. for 454·89 lb. fat in the junior two-year-old class.

The sire of Ivondale Golden Rainbow is Aster's Golden Lad, and the dam is Ivondale Rainbow's Lass, who has two certificates of record, one for 358·20 lb. fat on a test commenced under two years of age, and one for 455·43 in 202 days at a commencing-age of 4 years 346 days. Aster's Golden Lad is sire of five C.O.R. daughters, including the junior two-year-old Ivondale Gold Star, 506·97 lb. fat, and Ivondale Golden Lass, a senior two-year-old with 601·62 lb. fat. The sire of Aster's Golden Lad is Viola's Golden Laddie, the well-known imported bull, and sire of twenty-one C.O.R. daughters. Ivondale Rainbow's Lass is sired by Ivondale's Rainbow, a bull of Mr. Petersen's breeding, who has six C.O.R. daughters, including one with over 600 lb. fat. The dam of Ivondale Rainbow's Lass and maternal granddam of Ivondale's Golden Rainbow is Ivondale's Queen of Belgium, who has a C.O.R. for the outstanding record of 738·85 lb. fat.

There are many well-known and proven animals represented in the pedigree of this new class-leader, and judging by the performance of this and other members of Mr. Petersen's herd he has builded on good blood lines. K.C.B., Belvedere Bilberry's Last, Rainbow, Belvedere Sunbeam, and Starbright are a few of the better-known names. At the close of her testing-period Ivondale Golden Rainbow was purchased by Mr. Truby King, of Stratford.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Jersey Lea Vi	S. Bowker, Ihakara, Levin	1 357	240·5	365	9,208·1	469·91
Gowanlea White Socks	J. Robb, Wanganui	1 328	240·5	365	8,233·6	461·30
Gowanlea Jewel	J. Robb, Wanganui	2 9	241·4	345	8,646·0	452·55
Jersey Lea Rose Leaf	S. Bowker, Ihakara, Levin	2 0	240·5	365	8,245·5	442·93
Distinction's Melba	W. T. Williams, Pukehou	1 352	240·5	349	7,373·2	426·77
Rioter's Lass	J. Hale, New Plymouth	1 268	240·5	339	7,234·5	422·59
Vernon Charming Primrose	G. R. and H. Hutchinson, Auckland	1 321	240·5	365	7,234·1	417·80

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Middlewood Lola ..	F. W. and H. M. Clough, Inglewood	1 326	240·5	365	6,093·4	408·25
Matchless Violet ..	F. J. Watson, Bull's ..	2 10	241·5	333	6,826·6	407·06
Bridge View Sweet Pea	A. L. Hooper, Mahoe ..	2 24	242·9	328	6,859·5	403·79
Swan's Fox's Crocus	Brakenridge and Pearson, Taupaki	2 66	247·1	365	7,342·7	401·48
Poneke Swan's Girly	C. S. Leggett, Motumaoho ..	2 8	241·3	365	7,143·6	397·75
Llangollen Honeybird	J. T. Entwisle, Cambridge ..	1 358	240·5	365	5,999·3	394·11
Orange Dale Rose ..	W. J. Hall and Son, Matatoki	1 320	240·5	365	6,700·9	393·73
Maiden's Hopeful ..	J. J. Goodwin, Morrinsville	2 21	242·6	328	7,950·8	393·24
Ku Ku Topsy ..	W. Devine, Palmerston North	1 313	240·5	356	7,217·9	391·88
Olga of Bull's ..	F. J. Watson, Bull's ..	1 356	240·5	331	6,471·0	377·34
Some Flapper ..	J. E. Rae, Taneatua ..	1 350	240·5	365	6,668·3	370·79
Derry's Lucky One ..	S. J. Robinson, Hinuera ..	1 354	240·5	333	6,401·9	350·93
Vixen's Golden Sunshine	R. E. Clements, Awakino Point	1 337	240·5	343	6,331·3	347·97
Tirohia Majestic Star	B. E. Veale, Tirohia ..	2 8	241·3	365	6,954·2	342·17
Remuera Boquet ..	G. F. Edwards, Midhirst ..	2 73	247·8	296	5,750·5	329·76
Hilltop Light ..	F. C. Butt, Opotiki ..	2 24	242·9	291	5,695·7	321·88
Mountain Meadow's Creeper	F. C. Butt, Opotiki ..	2 4	240·9	279	6,181·8	310·20
Lucina's Cream ..	F. C. Butt, Opotiki ..	2 3	240·8	305	7,030·3	302·89
Glen-Leam Fancy ..	C. Flowerday, Morrinsville ..	1 210	240·5	349	5,252·8	296·45
Marshlands Model ..	A. E. Peppercorn, Cambridge	1 307	240·5	365	4,135·4	295·73
Ashton Pearl ..	G. R. and H. Hutchinson, Auckland	1 316	240·5	342	5,441·3	295·60
Green Park Lass ..	H. E. Walters, Waitoa ..	1 361	240·5	320	4,948·8	267·02
Mountain Meadow's Pet	F. C. Butt, Opotiki ..	2 47	245·2	303	5,009·8	258·33
Senior Two-year-old.						
Ivondale Golden Rainbow	P. J. Petersen, Waitara ..	2 311	271·6	365	12,962·2	768·46
Wairere Countess ..	A. Faull, Stratford ..	2 353	275·8	362	10,882·5	693·11
Miro Meadows May ..	J. D. Morison, Ngaere ..	2 356	276·1	365	10,376·1	610·01
Pelynn Chloe ..	L. K. Tarrant, Ngaere ..	2 269	267·4	364	8,705·0	602·13
Snow View Blossom	A. J. Miller, Uruti ..	2 325	273·0	303	7,265·7	466·45
Fox's Snow Queen ..	G. Bright, Otaua ..	2 312	271·7	365	9,372·9	452·21
Llangollen Beauty ..	J. T. Entwisle, Cambridge ..	2 356	276·1	365	9,504·2	431·90
Arden Viola's Bess ..	R. W. Ferris, Masterton ..	2 320	272·5	311	6,619·6	418·25
Lady Iva	W. Robinson, Patumahoe ..	2 332	273·7	301	8,110·8	411·60
Glyndyfrdwy Girl ..	H. E. Walters, Waitoa ..	2 334	273·9	316	6,942·7	343·97
Hua Brook Golden Maid	T. H. Western, Bell Block ..	2 322	272·7	327	5,696·9	333·95
Matchless Gold of Bull's	F. J. Watson, Bull's ..	2 346	275·1	365	6,169·4	329·26
Reid Park Miss Elizabeth	A. H. Wright, Otaua ..	2 334	273·9	275	5,017·5	306·31
Three-year-old.						
Speck's Marigold ..	J. Torbet, Waiau Pa ..	3 331	310·1	365	10,132·9	536·65
Onaero Sunshine ..	J. D. Morison, Ngaere ..	3 322	309·2	365	8,385·8	498·34
Beresford Prim ..	T. Brownlee, Pukekohe ..	3 308	307·8	352	7,350·6	486·46
Almadale Be Be ..	J. K. Watson, Tatuanui ..	3 232	300·2	365	8,759·2	483·65
Hua Brook Dulcet ..	H. Salway, Bell Block ..	3 341	311·1	309	8,717·3	451·54
Gift's Viola ..	F. Phillips, Otorohanga ..	3 303	307·3	365	8,371·3	424·98
Woodlands Melba ..	T. H. Western, Bell Block ..	3 340	311·0	348	6,934·7	395·88
Belvedere Radiance	R. W. Ferris, Masterton ..	3 361	313·1	280	7,795·4	393·45
Marshlands Dora ..	W. Bottomley, Waihou ..	3 227	299·7	359	7,395·8	386·89

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Three-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Rosebrae Queen ..	J. Blake, Puni ..	3 27	279·7	349	6,749·8	378·06
Florrie's Luckie ..	A. E. Sly, Whakaronga ..	3 364	313·4	329	8,440·8	363·01
Marshlands May Queen	W. Bottomley, Waihou ..	3 360	313·0	360	6,535·0	338·73
Earlston Violet ..	Chisholm Bros., Hunterville	3 271	304·1	283	5,782·5	307·08
Four-year-old.						
Woodlands Jeanette..	H. E. Watkin, Takanini ..	4 320	345·5	365	10,259·1	609·61
Crofton Sweet Molly..	F. W. and H. M. Clough, Inglewood	4 338	347·3	365	8,146·1	536·93
Ivondale Rainbow's Lass	P. J. Petersen, Brixton ..	4 346	348·1	202	8,260·3	455·43
Lad's Fairy ..	A. E. Peppercorn, Cambridge	4 13	314·8	365	7,620·7	430·73
Holly Oak War Nurse	T. H. Western, Bell Block..	4 213	334·8	262	6,212·8	399·35
Mature.						
Mason's Armistice ..	R. Waterhouse, Ardmore ..	5 225	350·0	365	11,122·7	726·01
Wairere's Dairymaid	A. Faull, Stratford ..	6 7	350·0	361	10,821·6	670·67
Lyndon Mantilla ..	E. Feilding, Drury ..	5 319	350·0	365	11,005·6	639·19
Lyndon Flower Girl	S. J. Robinson, Hinuera ..	6 310	350·0	358	9,991·0	626·78
Rockview Pride ..	G. R. and H. Hutchinson, Auckland	5 4	350·0	361	9,783·8	555·90
Trelawny Buttercup..	J. Mitchell, Woodville ..	8 363	350·0	351	10,474·5	509·71
Cedar	J. S. Barrowclough, Morrinsville	7 317	350·0	365	8,434·1	472·13
Bilberry's Joy ..	H. G. Lever, Tauranga ..	6 318	350·0	357	8,773·8	438·82
Diamond's Dawn ..	C. S. Leggett, Motumaoho..	5 295	350·0	365	9,123·3	437·19
White Velvet ..	J. S. Barrowclough, Morrinsville	7 350	350·0	285	5,898·6	414·39
Jewel's Sapphire ..	H. G. Lever, Tauranga ..	6 201	350·0	309	6,976·8	407·95
Jersey Bank Daisy ..	A. J. Miller, Uruti ..	7 313	350·0	308	8,562·0	390·65
Glyndyfrdwy Beauty	H. E. Walters, Waitoa ..	5 294	350·0	321	8·044·2	375·08
	FRIESIANS.					
Junior Two-year-old.						
Woodlands Pontiac May 6th*	Smart and Sons, Tikorangi	2 169	257·4	365	14,444·5	599·15
Castlemere Corona Beets*	J. W. Cole, Horsham Downs	1 296	240·5	356	17,697·4	488·83
Livingstone Lady Mierlo	W. J. Eames, Hunterville ..	2 142	254·7	355	12,170·3	427·92
Lichfield 28 ..	W. J. Polson, Fordell ..	1 348	240·5	365	11,740·4	412·35
Junior Three-year-old.						
Lichfield Lady ..	W. J. Polson, Fordell ..	3 9	277·9	363	13,770·6	501·25
Brundee Bonheur ..	C. Boyce, Tatuanui ..	3 33	280·3	343	9,846·1	343·5[illegible]
Senior Three-year-old.						
Cluny Pietje Hope 13th*	O. A. Cadwallader, Greytown	3 212	298·2	348	16,584·0	618·40
Omaha Spot ..	A. Migounoff, Matakana ..	3 350	312·0	353	12,354·5	492·69
Senior Four-year-old.						
Brookfield Pietertje Flo*	J. W. Cole, Horsham Downs	4 332	346·7	304	16,931·9	503·72
Lichfield Seven ..	W. J. Polson, Fordell ..	4 354	348·9	365	15,651·6	478·63

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	FRIESIANS—*continued*.					
Mature.		Yrs. dys.	lb.		lb.	lb.
Waihi Girl* ..	J. E. O'Shea, Ohangai ..	8 6	350·0	346	18,463·0	628·78
Brookfield Constance Paxton	A. Migounoff, Matakana ..	5 223	350·0	314	16,576·7	609·87
Lichfield Three ..	W. J. Polson, Fordell ..	5 1	350·0	363	15,215·6	477·43
Ashlynn de Kol ..	W. J. Polson, Fordell ..	8 6	350·0	365	10,905·5	455·58
	MILKING SHORTHORNS.					
Junior Two-year-old.						
Ridgway Tulip* ..	E. Ridgley, Waiuku ..	1 364	240·5	365	9,894·2	430·56
Senior Two-year-old.						
Matangi Quality 5th*	Ranstead Bros., Matangi ..	2 204	260·9	365	11,752·8	542·66
	AYRSHIRES.					
Two-year-old.						
Glengyle Mountain Lily	McAdam Bros., Queenstown	2 36	244·1	288	6,045·5	250·00
Mature.						
Kathleen of Edendale	W. Hall, Lepperton ..	5 22	350·0	365	10,646·0	447·56
	RED POLLS.					
Mature.						
Tourist	B. W. Harvey, Waverley ..	7 263	350·0	280	9,674·5	379·27
	Second-class Certificates.					
	Jerseys.					
Junior Two-year-old.						
Briar Rose's Brilliant	F. Phillips, Otorohanga ..	1 231	240·5	365	7,183·5	326·85
Tirohia Briar Berry ..	B. E. Veale, Tirohia ..	1 178	240·5	365	4,898·7	296·25
Corra Lynn Roseleaf	A. Best, Bombay ..	2 60	246·5	365	4,165·6	257·32
Senior Two-year-old.						
Odd Trick	S. Dale, Fairlie	2 327	273·2	365	9,327·2	581·45
Palmdale Majestic Queen	D. Kennedy, Morven ..	2 135	254·0	365	7,785·2	550·15
Xenia's Juillette ..	S. Dale, Fairlie	2 362	276·7	20	4,830·7	318·55
Mature.						
Melia Ann's Last ..	J. Klenner, Kaimata ..	6 291	350·0	365	9,774·0	650·19
	Friesians.					
Senior Two-year-old.						
Coldstream Pontiac Colleen*	O. A. Cadwallader, Greytown	2 299	270·4	365	16,777·0	649·90
Junior Three-year-old.						
Taumata Abbekerk Cornella*	Mrs. A. M. Budd, Carterton	3 73	284·3	365	7,796·6	689·85

WEATHER RECORDS: SEPTEMBER, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

SEPTEMBER, the first month of spring in New Zealand, this year presented samples of all the seasons. The outstanding feature, however, was one of the most extensive snowstorms within memory. The falls were not heavy, but fairly general over the Dominion southward of Raglan and Tauranga. One observer, however, states that it was the heaviest known on the east coast of the North Island for forty-six years; 4 in. fell at Havelock North and 2½ in. at Masterton. Our observer at Hokitika says that 1 in. measured there was the only fall of snow remembered in the town itself for thirty years. The storm on the 16th was accounted for by a westerly or "antarctic low," and was followed by a very sharp frost on the morning of the 17th. Heavy west to south-west gales were recorded at this time, and the middle part of the month was remarkable for rough wintry weather.

The first week of the month was showery, and the last fine and warm, with beneficial rainfall at the close. Bright sunny days alternated with frosty nights along the east coast during the greater part of the month.

The rainfall for the month was below the average for September, especially on the east coast of both Islands, but it was considerably above the average on the west coast southward of Ross, and over Otago and Southland.

RAINFALL FOR SEPTEMBER, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	4·22	13	1·10	4·75
Russell	2·29	11	0·45	3·42
Whangarei	3·21	15	0·55	4·88
Auckland	2·87	16	0·52	3·65
Hamilton	3·44	13	1·22	4·37
Kawhia	4·30	16	1·60	4·39
New Plymouth	2·82	17	0·74	5·27
Riversdale, Inglewood	5·17	14	1·06	9·48
Whangamomona	5·03	17	0·85	7·57
Tairua	3·08	11	0·52	4·64
Tauranga	3·09	11	0·68	4·41
Maraehako Station, Opotiki ..	1·74	10	0·64	4·28
Gisborne	1·11	6	0·47	3·01
Taupo	3·05	9	1·38	3·71
Napier	0·73	9	0·30	2·19
Maraekakaho Station, Hastings ..	1·24	13	0·60	2·58
Taihape	2·23	14	0·54	3·44
Masterton	2·05	13	0·51	3·13
Patea	2·06	10	0·57	3·63
Wanganui	1·36	9	0·47	3·05
Foxton	2·86	10	1·20	2·43
Wellington	1·94	14	0·44	4·02
South Island.				
Westport	3·95	22	0·95	6·82
Greymouth	6·41	21	1·53	8·26
Hokitika	8·74	21	1·74	9·33
Ross	14·84	19	3·42	13·06
Arthur's Pass	15·30	17	3·85	14·96
Okuru, Westland	15·20	19	3·43	12·48
Collingwood	5·49	12	1·41	10·13

RAINFALL FOR SEPTEMBER, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Nelson	2·43	9	0·97	3·75
Spring Creek, Blenheim	1·76	9	0·55	2·64
Tophouse	5·12	10	1·23	4·81
Hanmer Springs	2·18	11	1·04	4·20
Highfield, Waiau	1·16	7	0·42	3·35
Gore Bay, Cheviot	0·66	4	0·33	4·28
Christchurch	0·63	9	0·20	1·79
Timaru	1·02	9	0·36	2·07
Lambrook Station, Fairlie	1·00	6	0·38	2·30
Benmore Station, Clearburn	2·68	12	0·60	2·14
Oamaru	1·73	8	0·73	1·69
Queenstown	3·15	11	0·83	2·52
Clyde	0·87	10	0·20	1·06
Dunedin	3·29	17	0·85	2·74
Wendon	3·61	15	0·50	2·12
Gore	4·20	17	0·55	2·52
Invercargill	5·32	18	0·68	3·11
Puysegur Point	7·16	20	1·08	5·53

—*D. C. Bates, Director.*

CONTROL OF DEER.

REFERENCE is made to this question in the 1925–26 annual report of the State Forest Service as follows :—

Since its inception the Forest Service has consistently advocated the control of deer, which have increased at such an alarming rate that their depredations in farming-lands and forests are now widely acknowledged. All Conservators report an increase in the number of these vermin, and the Service is more than ever of the opinion that protection on all species of deer should be removed for a period of at least three years, and that the payment of bounty on killed deer should be continued during that time. Concrete evidence of the attitude adopted towards this pest by settlers residing near infested areas was recently furnished to the Service in a peculiar manner, when the Crookston farmers, who have suffered severely from the depredations of fallow deer for many years, urged delay in the State forestation project in the Blue Mountains in South Otago on the ground that the exotic forests so created would become a refuge for these animals. An impression of how serious the deer menace has become in this district may be obtained from the fact that out of 5,877 deer-tails collected by forest officers in the South Island for the purpose of payment of the bounty of 2s. per tail, 3,890 tails were received from the Blue Mountains area alone.

AGRICULTURAL PUBLICATIONS.

AMONG recent books issued by the University Tutorial Press, High Street, London W.C., are the following : "Agricultural Surveying, including Mensuration, Road Construction, and Drainage," by John Malcolm (5s. 6d.) ; and "The Principles and Practice of Horticulture," by A. S. Galt (3s. 6d.). "Mechanisms : A Text-book for the Use of Non-technical Students," by Ewart S. Andrews (3s. 6d.), is another new book published by the same house which many farmers would find useful.

Noxious-weeds Order.—The Hokianga County Council has declared foxglove to be a noxious weed within that county.

ANNUAL SHEEP RETURNS AS AT 30TH APRIL, 1926.

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

Class.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago (including Southland).	Total in Dominion.
Stud rams	966	1,073	3,572	906	4,375	2,916	13,808
Other rams	30,557	89,640	76,436	19,348	74,239	66,507	356,727
Wethers	362,910	627,785	719,684	233,274	583,369	685,413	3,212,435
Breeding-ewes	1,192,736	3,379,198	2,931,266	717,866	3,053,533	2,673,653	13,948,252
Dry ewes	98,600	341,901	222,926	54,458	212,038	149,812	1,079,735
Lambs	558,834	1,796,614	1,395,552	327,223	1,043,768	1,172,045	6,294,036
Totals, 1926	2,244,603	6,236,211	5,349,436	1,353,075	4,971,322	4,750,346	24,904,993
Totals, 1925	2,092,244	6,344,990	5,282,307	1,351,889	4,984,062	4,492,463	24,547,955

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1917–26.

Year.	Stud and Flock Rams.	Stud Breeding-ewes.	Stud Dry Ewes.	Stud Lambs.	Total Stud Sheep and Flock Rams.	Sheep of Distinctive Breed not entered in Flock-books, and Crossbred Sheep.				Grand Total, Stud and other Sheep.
						Wethers.	Breeding-ewes.	Dry Ewes.	Lambs.	
1917	329,230	160,212	6,212	114,778	610,432	3,457,824	13,099,957	1,066,435	7,035,738	25,270,386
1918	325,111	171,437	6,297	125,116	627,961	3,696,520	12,850,597	1,592,452	7,770,772	26,538,302
1919	321,304	165,676	12,196	127,150	626,326	3,922,632	12,176,224	1,799,201	7,304,171	25,828,554
1920	306,621	154,516	9,803	109,454	580,394	3,901,742	11,415,159	1,814,391	6,208,284	23,919,970
1921	322,144	158,608	9,513	110,428	600,693	3,634,799	11,989,180	1,336,306	5,724,053	23,285,031
1922	322,072	154,277	7,259	98,221	581,829	2,727,624	12,341,777	952,789	5,618,240	22,222,259
1923	330,055	172,843	9,013	119,749	631,660	2,551,627	12,890,160	808,919	6,199,073	23,081,439
1924	332,814	179,533	9,727	132,137	654,211	2,807,832	12,896,561	1,036,723	6,381,249	23,775,776
1925	355,579	184,744	7,867	131,485	679,675	3,063,663	13,530,479	875,899	6,398,239	24,547,955
1926	370,535	192,055	10,053	138,526	711,169	3,212,435	13,756,197	1,069,682	6,155,510	24,904,993

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS, AND OF CROSSBREDS, IN EACH SHEEP DISTRICT (1926).

Breed.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Total in North Island.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago.	Total in South Island.	Total in Dominion.
Stud sheep (entered in flock-books)—									
Merino	..	1	22	23	10,824	14,164	5,423	30,411	30,434
Lincoln	530	2,555	9,105	12,190	592	202	799	1,593	13,783
Romney	15,882	15,690	79,890	111,462	9,580	5,911	33,816	49,307	160,769
Border Leicester	330	..	468	798	292	10,839	11,860	22,991	23,789
English Leicester	962	627	214	1,803	1,237	16,661	385	18,283	20,086
Shropshire	306	..	1,124	1,430	326	3,176	666	4,168	5,598
Southdown	2,869	7,141	22,563	32,573	805	12,308	1,078	14,191	46,764
Corriedale	508	..	869	1,377	535	32,779	11,277	44,591	45,968
Other breeds	465	560	444	1,469	1,337	3,699	746	5,782	7,251
Totals	21,852	26,574	114,699	163,125	25,528	99,739	66,050	191,317	354,442
Sheep of a distinctive breed but not entered in flock-books—									
Merino	6,517	5,239	15,208	26,964	199,313	391,408	326,710	917,431	944,395
Lincoln	5,025	50,694	18,507	74,226	4,250	15,056	8,650	27,956	102,182
Romney	313,051	1,253,573	753,189	2,319,813	111,102	72,884	382,627	566,613	2,886,426
Border Leicester	4,668	2,562	3,798	11,028	1,160	29,947	48,912	80,019	91,047
English Leicester	2,727	857	632	4,216	7,287	43,255	4,083	54,625	58,841
Shropshire	3,883	1,044	1,486	6,413	1,111	5,129	1,888	8,128	14,541
Southdown	4,917	18,236	34,995	58,148	4,371	16,324	1,989	22,684	80,832
Corriedale	2,770	8,645	39,372	50,787	33,898	448,290	324,265	806,453	857,240
Half-breds	4,238	6,474	10,902	21,614	223,028	619,177	330,140	1,172,345	1,193,959
Other breeds	676	783	1,842	3,301	3,967	6,280	1,626	11,873	15,174
Totals	348,472	1,348,107	879,931	2,576,510	589,487	1,647,750	1,430,890	3,668,127	6,244,637
Crossbreds and others not otherwise enumerated	1,874,279	4,861,530	4,354,806	11,090,615	738,060	3,223,833	3,253,406	7,215,299	18,305,914
Grand totals	2,244,603	6,236,211	5,349,436	13,830,250	1,353,075	4,971,322	4,750,346	11,074,743	24,904,993

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

DISTEMPER IN DOGS.

J. BARKER, Hastings:—

I should be glad if you would give information as to best treatment and effective preventive measures for the malady that has been killing a number of dogs in the South Island recently. The disease is spoken of sometimes as distemper and at other times as influenza in dogs.

The Live-stock Division:—

The disease you refer to, which has been prevalent recently in certain parts of the North Island as well as the South Island, is popularly known as distemper in the dog. It occurs in several forms, the symptoms depending upon the parts involved. It varies from catarrh of the eyes and nose to pneumonia, when the lungs are involved. A gastric or intestinal form is also met with, and occasionally skin-eruptions appear on the inside of the legs. Nervous complications frequently follow, indicated by symptoms ranging from twitching of the muscles to inability to stand. From this it can be understood that treatment depends entirely on the symptoms shown in the particular case. Speaking generally, the disease is ushered in by a rise in temperature, loss of appetite, and dullness. Other symptoms such as coughing, vomiting, &c., develop later. To treat distemper successfully good nursing, combined with warm, well-ventilated quarters, are the two great essentials. To maintain the dog's strength concentrated food in small amounts should be given frequently. Nothing is more useful than Brand's essence of beef, a teaspoonful being given every few hours. A few beaten-up eggs, to which a tablespoonful of brandy and a little milk have been added, should be prepared, and a little of this given three times daily. Fresh milk is good if the dog will take it. Medicinally there is no specific, and for most cases a one-grain quinine pill given morning and evening is as useful as anything else. If the mouth is foul, it may be mopped out with hydrogen peroxide, one part to six of water. The same lotion may be used to cleanse the eyes and nostrils. Dogs recovering from distemper require a long convalescence and nourishing diet. Regarding prevention: During an epidemic dogs must be kept as free as possible from contact with affected animals, and frequent disinfection of kennels, &c., carried out. Success has been claimed from the use of preventive vaccines, but their usefulness has not been established.

LUPINS; WHITE CLOVERS; TURNIP-FLY.

J. G. S., Pirinoa:—

(1.) Would you recommend lupins for green-manuring on land with dark soil but clay very near the top—in places coming up with the plough? If so, what variety of lupin, quantity of seed, best time to sow, and manure to be used?

(2.) I am sowing a bush-burn this coming year on hill country. Is there any difference in the varieties of white clovers? If so, which would you recommend?

(3.) Which months of the sowing season are most immune from the turnip-fly? Last season the turnips were swept off in the two-leaf stage by the pest.

The Fields Division:—

(1.) We take it your desire is to deepen and enrich the top soil. If so, it would certainly be benefited by green-manuring with lupins, and you would find this method much quicker than the usual practice of gradual improvement by ploughing an inch deeper each time. Sow 1½ bushels annual blue lupin, with 2 cwt. to 3 cwt. super, per acre, early in November. Work the land as for any ordinary crop, and endeavour to obtain a heavy yield for ploughing in. Plough in the crop as soon as the spikes begin to come out in flower; nothing is gained by waiting longer.

(2.) Use the ordinary New-Zealand-grown white-clover seed. This is much more permanent than imported Dutch, and ranks almost, if not quite, as high as the wild white clover of Britain.

(3.) The first flight of turnip-fly usually takes place some time in November, the actual time varying according to the season. An endeavour should be made to sow so that the turnip-plants will have developed the rough-leaf stage at this time, or else wait until after the flight has taken place. The so-called fly—the large brown beetle, adult form of the grass-grub—damages turnip crops while in the two-leaf stage. The second main flight takes place during February or the beginning of March.

CONTROL OF BLACKBIRDS IN THE ORCHARD.

"IGNOTUS," Remuera, Auckland :—

Can you suggest any method of getting rid of blackbirds ? Owing to the by-laws I am unable to use the gun, and their depredations render the growing of peaches almost impossible.

The Horticulture Division :—

The campaign against birds attacking fruit in the orchard should be commenced early in the season, so that the habit of feeding there may be checked. The usual method is to poison the birds with strychnine placed in ripe fruits which are laid on the ground, but a few twigs of good Syrian birdlime would probably be quite a satisfactory control for blackbirds in a small orchard.

REARING MOTHERLESS LAMBS.

"PET LAMB," Silverhope :—

Please inform me which is the best way to rear motherless lambs, and what formula is needed.

The Live-stock Division :—

Motherless lambs are frequently and successfully reared on cow's milk. When this method is adopted the milk should be that of a cow giving a good butterfat test, or, if such cannot be obtained, a little cream should be added to normal milk (not skim-milk). For the first few days only small amounts—two or three tablespoonfuls—should be fed, the feeding being done every two or three hours. The milk should be placed in a bottle the mouth of which is covered by a medium-sized nipple, and the whole warmed to blood-heat (approximately 100° F.). The nipple and bottle should always be carefully cleaned, or digestive trouble will arise among the lambs being fed. Substitutes for milk have been tried, but not generally adopted as they are far from being successful.

FEEDING OF PIGS.

T. WILSON, Otekaike :—

Would you please let me know if pigs turned on lucerne will require any other food, and, if so, what kind and how much ? The pigs are about three months old (baconers). Also, can brood sows be turned on lucerne with the young pigs, and what extra feed will they require ?

The Live-stock Division :—

Lucerne or any other green forage is not a sufficient ration in itself, but should be supplemented by a light feeding of grain daily for the three-months-old pigs, and increased as they get older. The usual method is to feed from 1 to 3 per cent. of grain, according to age and size. Barley, peas, oats, and maize are suitable grains. Other foods, such as skim-milk and pollard, can be used when available. Breeding-sows with young should have a liberal supply when suckling. Afterwards when dry they can maintain themselves on lucerne or other green forages, but are always benefited by receiving a light ration of the above grains.

BLIGHTED WALNUTS.

J. V. CARLSON, Timaru :—

Could you give me the reason, in connection with a walnut-tree, why the walnut-shells are beautifully formed and look well, yet in most cases they contain only shrivelled nuts, and some are quite empty?

The Horticulture Division :—

Without seeing a sample, one would expect the nuts described to be the result of a late attack of walnut-blight (*Pseudomonas juglandis*). However, in a crop comparatively free from this disease one finds a percentage of blank, shrivelled, or mouldy nuts and dark-coloured kernels. The extent is usually considered to be in proportion to abnormally high temperatures, and to the trees suffering from drought during the latter part of the growing-period, or to trees which for some reason have lost their leaves prematurely. Possibly your trees are growing in unsuitable ground for producing a satisfactory crop of nuts. For this purpose good alluvial well-drained land is required.

FORTHCOMING AGRICULTURAL SHOWS.

Hawke's Bay A. and P. Society : Hastings, 20th and 21st October, 1926.
Poverty Bay A. and P. Association : Gisborne, 26th and 27th October.
Marlborough A. and P. Association : Blenheim, 27th and 28th October.
Wairarapa A. and P. Society : Carterton, 27th and 28th October.
Timaru A. and P. Association : Timaru, 27th and 28th October.
Manawatu A. and P. Association : Palmerston North, 2nd, 3rd, and 4th November.
Waikato A. and P. Association : Hamilton, 3rd and 4th November.
Ashburton A. and P. Association : Ashburton, 4th November.
Northern A. and P. Association : Rangiora, 5th November.
Wanganui A. and P. Association : Wanganui, 10th and 11th November.
Canterbury A. and P. Association : Christchurch, 11th and 12th November.
Royal Agricultural Society and Auckland A. and P. Society : Royal Show, Auckland, 16th and 18th November.
Wallace A. and P. Association : Otautau, 17th November.
North Otago A. and P. Association : Oamaru, 17th and 18th November.
Otago A. and P. Society : Dunedin, 24th and 25th November.
Egmont A. and P. Association : Hawera, 24th and 25th November.
Whangarei A. and P. Society : Whangarei, 24th and 25th November.
Stratford A. and P. Association : Stratford, 1st and 2nd December.
Wyndham A. and P. Society : Wyndham, 10th December.
Horowhenua A. and P. Association : Levin, 25th and 26th January, 1927.
Helensville A. and P. Association : Helensville, 29th January.
Golden Bay A. and P. Association : Motupipi, 1st February.
Feilding A. and P. Association : Feilding, 1st and 2nd February.
Woodville A. and P. Association : Woodville, 4th and 5th February.
Omaha and Pakiri A. and H. Association : Leigh, 5th February.
Te Puke A. and P. Association : Te Puke, 9th February.
Dannevirke A. and P. Association : Dannevirke, 9th, 10th, and 11th February.
Pahiatua A. and P. Association : Pahiatua, 12th February.
Rodney Agricultural Society : Warkworth, 12th February.
Masterton A. and P. Association ; Solway, 15th and 16th February.
Buller A. and P. Association : Westport, 18th and 19th February.
Marton A. and P. Association : Marton, 23rd February.
Franklin A. and P. Association : Pukekohe, 25th and 26th February.
Waikato Central Agricultural Association : Cambridge, 2nd and 3rd March.
Morrinsville A., P., and H. Society : Morrinsville, 9th March.
Amuri A. and P. Association : Waiau, 9th March.
Taranaki Metropolitan Agricultural Society : New Plymouth, 9th March.
Mayfield A. and P. Association: Mayfield, 19th March.
Temuka A. and P. Association : Geraldine, 7th April.

Association secretaries are invited to supply dates and location of their shows for publication in this list.

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DAIRY-HERD TESTING IN NEW ZEALAND.

REVIEW OF 1925–26 SEASON

(Concluded.)

W. M. SINGLETON, Director of the Dairy Division, and W. N. PATON.

ANALYSIS OF INDIVIDUAL RECORDS.

IN the 1925–26 season for the first time analyses of production records for all cows included in the summaries were requested, and in practically all instances satisfactory returns have been obtained. These analyses supply a better idea of the production for all tested cows than do arithmetical averages. An arithmetical average does not tell us how many cows are profitable or unprofitable, and this information is of considerable importance in considering the position of dairying. It is possible for culling to be done from one season to another and yet not show any effect in the arithmetical average. By chance, slight reduction in the proportion of higher-producing cows may leave the average practically the same as it was previously. An analysis of individual records, however, may reveal the position quite clearly. If these analyses are collected year by year much useful information will be obtained on improvement in average production of dairy cows through herd-testing.

Table 10 supplies the results obtained from the effective analyses returns received for the season's testing, and have been classified according to land districts, &c. All those records for cows in milk 100 days or over, and included in annual summaries, have been utilized in this table. Instead of quoting the actual number of records for the various classes these have been reduced to percentages to facilitate comparison. The total numbers of cows to which the percentages refer are given on the extreme right of the table. Where numbers of records are so low that the resulting percentages are less than 0·01, and therefore insignificant, asterisks have been inserted. The limits of classes as given in this table may not be quite clear to readers, and by way of explanation these may be amplified as follows: Under 50 lb.; 50 lb. and under 100 lb.; 100 lb. and under 150 lb.; and so on. They have been given in the abbreviated form only because of lack of space.

Table 10.—Percentage Distribution of Records for all Tested Cows represented in Effective Annual Summaries received, classified according to Land Districts, &c., Season 1925–26. (Basis: In Milk 100 Days or over.)

Land District, &c.	Class Limits (in Pounds of Butterfat).																	Total Number of Cows classified.
	Under 50.	50–100.	100–150.	150–200.	200–250.	250–300.	300–350.	350–400.	400–450.	450–500.	500–550.	550–600.	600–650.	650–700.	700–750.	750–800.	800–850.	
North Auckland ..	0·54	5·73	17·46	24·58	22·98	15·90	8·44	3·14	0·91	0·23	0·09	0·01	..	..	..	..	..	20,925
Auckland	0·17	3·44	12·17	22·70	25·92	19·28	10·39	4·20	1·27	0·36	0·07	0·02	0·01	*	*	..	..	72,611
Gisborne	0·24	6·83	22·60	27·26	23·72	12·71	4·39	1·69	0·45	0·12	..	..	..	..	..	..	..	3,368
Hawke's Bay ..	0·33	8·27	22·71	27·29	21·77	12·11	4·98	1·68	0·70	0·16	..	..	..	..	..	..	..	4,294
Taranaki	0·03	1·49	8·35	19·76	26·34	23·53	12·89	5·29	1·70	0·47	0·11	0·02	0·02	..	..	..	..	12,846
Wellington.. ..	0·43	4·57	15·02	24·21	26·25	16·89	8·47	2·91	0·99	0·21	0·04	0·01	*	..	..	..	..	21,905
North Island ..	0·26	4·03	13·67	23·21	25·38	18·38	9·70	3·79	1·17	0·31	0·07	0·01	0·01	*	*	..	..	135,949
Nelson	..	4·11	11·91	27·10	26·90	16·22	9·24	3·08	1·03	0·41	..	..	..	..	..	..	..	487
Canterbury ..	..	2·05	17·39	24·55	25·32	17·90	8·70	2·56	0·77	0·77	..	..	..	..	..	..	..	391
Otago	..	3·11	17·16	22·64	24·75	15·42	8·96	4·23	1·74	0·87	0·75	0·25	..	..	..	..	0·12	804
Southland	0·67	3·60	14·14	28·28	28·66	15·59	6·52	1·88	0·44	0·14	0·04	..	..	0·01	..	0·01	..	8,017
South Island ..	0·56	3·53	14·41	27·60	28·12	15·70	6·95	2·17	0·59	0·24	0·09	0·02	..	0·01	..	0·01	0·01	9,699
Dominion ..	0·28	3·99	13·72	23·51	25·56	18·21	9·51	3·68	1·13	0·31	0·07	0·01	0·01	*	*	*	*	145,648

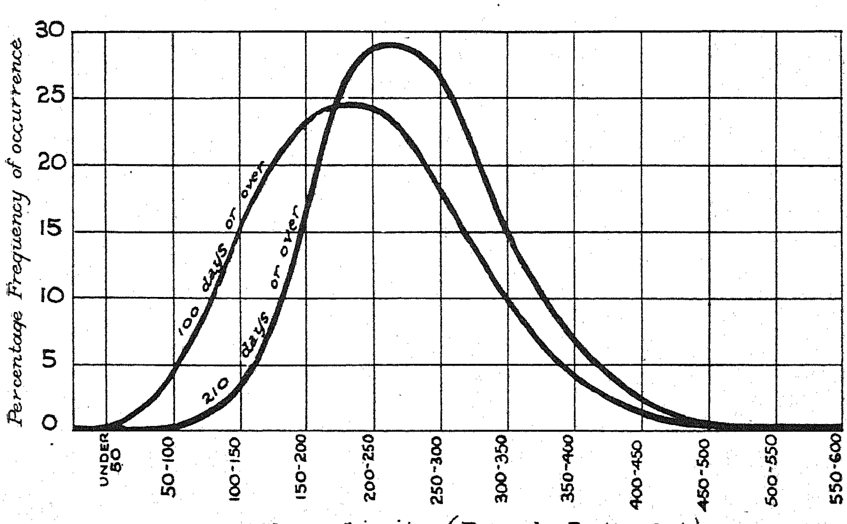
* Data occurring, but relatively insignificant.

This table may be conveniently studied in conjunction with Table 8, to which it should prove a useful supplement. The total number of cows for the various land districts are the same for both tables, with the exception of Auckland, Wellington, and Nelson. In these cases one return for each has been omitted, owing to the analyses of records not being in order or not supplied. The differences in numbers for Auckland and Wellington are so relatively small that they do not detract from the value of comparison of the two tables. The results for Nelson, Canterbury, and Otago are so sparse that no great importance can be attached to these cases, and have been included only for interest and to complete the table.

In order to illustrate the difference in distribution of records for results from the two systems of testing Table 11 has been compiled. In the upper half of the table numbers of records are given, while in the lower half these have been converted to percentages, as in the case of Table 10. This table may be conveniently studied in conjunction with Table 6, together with the remarks relating thereto.

Similarly, Table 12 and Graph 2 are supplied to supplement Table 7 and the comment thereon. Graph 2 presents the data shown in Table 12, with the exception that the curves have been "smoothed" slightly. This graph may serve to show how results would appear if stringent culling had been effected, for, virtually, when from the same data summaries are compiled on the two bases—100 days or over and 210 days or over—culling has been done, only it is with records instead of cows.

Table 12 also shows distribution of herd averages compiled on the two bases for all associations for which testing was done by the Dairy Division's officers.



GRAPH 2. COMPARISON OF THE PERCENTAGE FREQUENCY DISTRIBUTION OF RECORDS ACCORDING TO THE TWO BASES—ALL COWS IN MILK 100 DAYS AND 210 DAYS OR OVER RESPECTIVELY. (DATA RESULTING FROM ALL ASSOCIATIONS CONTROLLED BY DAIRY DIVISION.)

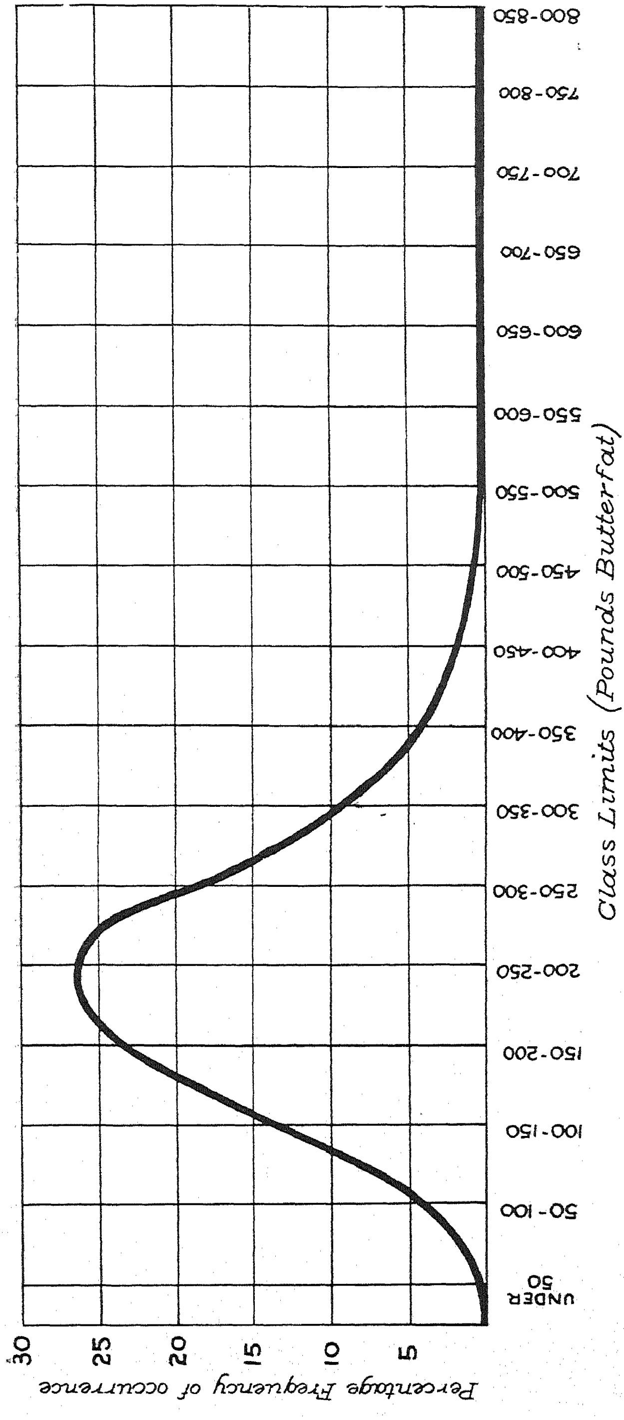
Table 11.—Distribution of Records for all Tested Cows in the Dominion represented in Effective Annual Summaries received, Season 1925–26. (Basis : In Milk 100 Days or over.)

System.	Class Limits (in Pounds of Butterfat).																	Total Number of Cows classified.
	Under 50.	50–100.	100–150.	150–200.	200–250.	250–300.	300–350.	350–400.	400–450.	450–500.	500–550.	550–600.	600–650.	650–700.	700–750.	750–800.	800–850.	
Numbers.																		
Association ..	122	2,207	7,853	11,351	11,488	8,211	4,293	1,745	582	163	46	9	2	..	..	..	1	48,073
Group ..	285	3,610	12,133	22,886	25,738	18,306	9,565	3,620	1,067	282	55	11	11	4	1	1	..	97,575
Both ..	407	5,817	19,986	34,237	37,226	26,517	13,858	5,365	1,649	445	101	20	13	4	1	1	1	145,648
Percentages.																		
Association ..	0·25	4·59	16·34	23·61	23·90	17·08	8·93	3·63	1·21	0·34	0·10	0·02	*	..	..	..	*	48,073
Group.. ..	0·29	3·70	12·43	23·45	26·38	18·76	9·80	3·71	1·09	0·29	0·06	0·01	0·01	*	*	*	..	97,575
Both ..	0·28	3·99	13·72	23·51	25·56	18·21	9·51	3·68	1·13	0·31	0·07	0·01	0·01	*	*	*	*	145,648

* Data occurring, but relatively insignificant.

Table 12.—Percentage Distribution of Records and Herd Averages for all Associations controlled by Dairy Division, Season 1925–26.

Basis.	Class Limits (in Pounds of Butterfat).												Total Number classified.
	Under 50.	50–100.	100–150.	150–200.	200–250.	250–300.	300–350.	350–400.	400–450.	450–500.	500–550.	550–600.	
Records.													Cows.
100 days or over	0·10	4·11	14·91	22·57	24·11	18·25	9·86	4·27	1·45	0·28	0·07	0·01	16,173
210 days or over	..	0·06	3·13	16·19	28·74	26·46	15·46	6·96	2·38	0·47	0·12	0·01	9,745
Herd Averages.													Herds.
100 days or over	..	4·17	15·59	24·87	25·54	20·30	6·59	2·55	0·27	0·13	..	..	744
210 days or over	..	..	2·05	12·50	34·14	32·84	13·25	4·66	0·37	0·19	..	..	536



GRAPH 3. PERCENTAGE FREQUENCY DISTRIBUTION OF RECORDS FOR ALL TESTED COWS REPRESENTED IN EFFECTIVE ANNUAL SUMMARIES RECEIVED. (BASIS: IN MILK 100 DAYS OR OVER.)

Graph 3 shows the frequency distribution curve compiled from the percentages quoted in Tables 10 and 11 for all tested cows in the Dominion included in satisfactory analyses received. By close inspection it will be observed that this curve does not slope similarly on both sides of the apex, or, in other words, it is not absolutely symmetrical. Apart from other points, it is more drawn out on the right-hand side of the base than on the left. This is due to the better response to feeding and care of some cows over others, although among such a large number of cows the law of chance will so operate that there are likely to be infinite degrees of feeding, quality of stock, conditions, &c., represented, and no one class proportionately more or less than its likelihood of occurrence. The peak of the curve corresponds to an average known in statistical phraseology as a "mode," and indicates a value which occurs with the greatest frequency. In other words, a perpendicular from this point to the base line gives a reading of approximately 222 lb. of butterfat, and this record, on investigation, should be found to occur more times than any other.

It is interesting to note that the arithmetical average for the same records included in this graph works out in round numbers as 221 lb. butterfat. Measuring from this 222 lb. point on the base line, we find that the distance to the left at which the curve more or less meets the base line is equivalent to about 200 lb. butterfat, while on the right-hand side it is about 300 lb. As mentioned, difference in production in response to feeding accounts for some of this effect, but also it is partly due to culling. Moreover, had we been able to obtain records for all cows to drying-off dates, and satisfactorily eliminated those cows previously mentioned which died, fell sick, were culled, or sold at periods during test considerably before their testing would have been completed, it should be found that the resulting frequency curve fell away more steeply on the left-hand side than on the right. This would then provide an effective measure for the extent to which poor-producing cows had been eliminated. It is hoped that at later dates, when more data are available, measures of this sort may be possible.

Table 13.—Analysis of Production of Cows in a Large Association for Past Five Seasons. (100-day Basis.)

Class, &c.	Percentage of Total Cows.				
	1921-22.	1922-23.	1923-24.	1924-25.	1925-26.
Under 150 lb.	50·6	39·3	40·8	35·3	28·9
150–200 lb.	29·8	34·3	32·8	31·5	23·7
200–250 lb.	13·8	18·7	18·1	21·0	28·4
250–300 lb.	4·1	6·1	6·6	8·6	11·7
300–350 lb.	1·4	1·4	1·4	2·3	3·7
350–400 lb.	0·3	0·2	0·2	1·0	2·0
400–450 lb.	..	..	..	0·3	1·2
450–500 lb.	..	..	..	..	0·2
500–550 lb.	..	..	..	..	0·2
Percentage under 200 lb.	80·4	73·6	73·6	66·8	52·6
Percentage 200 lb. or over	19·6	26·4	26·4	33·2	47·4
Average butterfat per cow	158·05	167·79	167·96	177·96	196·78
Average days in milk	201	214	219	215	213

An association for which analyses are available covering a period of five years, and during which time gradual improvement in average production has been effected, affords a good example of the use to which analyses of individual records of cows may be put. These particulars are supplied in Table 13.

AVERAGE PRODUCTION LIMITED BY SIZE OF HERD.

Table 14 has been compiled from the season's results for a large association, and is intended to give an indication on variation in average production with size of herd. Only those herds were included in the classification which showed 200 or more days as the average days in milk since calving. The figures used were compiled on the basis of cows in milk 100 days or over, for if the 210-day basis were used some cows would probably be eliminated and not give a correct index of the real size of the herds. As it is, some cows in a few herds may have been in milk less than 100 days, but there is not so much chance of this as in the case of the 210-day basis. It is unfortunate that no information was on hand in regard to which herds were hand- or machine-milked. We hope, however, to obtain data along this line in the near future.

This table shows a steady decrease in average production for increase in size of herd, but it would not be wise to take this case as being typical. It presents, however, a phase of dairying which should be given due consideration, and one which is full of interest. It will be noticed that at the 36–40 cows class a break is made in the sequence of the gradual decline of average production, and from this point onwards another stage of decrease occurs. At this point it might with some safety be assumed that extra labour was introduced, and that this would not be warranted in the immediately preceding cases. As previously mentioned, however, both hand and machine milking are represented, and no very definite conclusions could be made on the location of the extra-labour point until the data had been divided for this factor.

Table 14.—Average Production classified according to Number of Cows per Herd: Data from One Large Association, Season 1925–26. (Basis: 100 Days or more, including only those Herds 200 Days in Milk or over.)

Class Limits: Cows per Herd.	Number of Herds.	Number of Cows.	Average Days in Milk.	Average Butterfat per Cow.	Average Butterfat per Day per Cow.
				lb.	lb.
1–5 ..	8	35	269	315·42	1·17
6–10 ..	12	90	255	276·91	1·08
11–15 ..	16	206	251	257·98	1·03
16–20 ..	12	223	241	230·68	0·96
21–25 ..	10	235	247	229·62	0·93
26–30 ..	5	145	245	222·42	0·91
31–35 ..	4	128	249	206·76	0·83
36–40 ..	6	231	230	236·05	1·03
41–50 ..	5	224	250	222·79	0·89
51–60 ..	2	108	231	204·90	0·89
61–70 ..	1	63	238	206·48	0·87
71–80 ..	3	217	255	190·99	0·75

HERD-TESTING CHARGES.

In order to gain some idea of the average charge per cow made for herd-testing in the Dominion a query on this point was included in our questionnaire this year. The answers obtained indicate that, on the whole, charges are very reasonable and have evidently been kept as low as possible. Quite a lot of testing-work is being done by dairy companies on behalf of their suppliers free of charge, the expenses being borne by the company in each case. This practice is to be encouraged, and is one which, if given more support, should assist the movement considerably. When a supplier realizes that his dairy company offers a testing service to him free of charge, except that the total cost is an overhead charge on the company and therefore incidentally borne in part by himself, it should be a great incentive for him to join up in the work, even if in a few cases this is done primarily to merely obtain his money's worth. Once participating in the work, the supplier will realize more fully what advantages there are in herd-testing, and never regret the steps his company took to provide the service.

Association System.

In the case of the Association system only one return failed to supply an indication of the charges made, and this represented only a few hundred cows. For 25 per cent. of the total cows tested twice or more under the Association system no direct charge was made—that is, the total cost was borne by the respective dairy companies. The total so represented amounted to 14,851 cows. Of the remainder, 19,804 cows were charged for at the rate of 2s. and 12,905 at 1s. 6d. per head, these being the two commonest charges. In three cases the charge was made on the basis "per test," and taking these at nine periods of testing each, and incorporating them with all those cases where the charge was on the "per season" basis, the average direct charge worked out at 2s. The number of cows represented in this average was 43,034, and this amounts to 72·5 per cent. of the total cows tested twice or more under the Association system. This leaves 2·5 per cent. unaccounted for, and is made up of the one case which did not supply an indication of the charge, and a few associations figured in the Dairy Division Head Office, for which figuring charges only were made. The testing in these cases was not performed by officers of the Dairy Division, and if a charge for testing were made by the dairy companies concerned it would cover testing only. Nearly 8 per cent. of the total cows tested twice or more under the Association system were included in associations conducted as business enterprises by independent testing officers, and the average charge levied was just under 2s. 6d. per head. The most general charge, however, in these cases was that of 2s.

Dairy Company System.

In thirteen cases, representing 1,066 cows, no indication of the charge was supplied, and for ten others (1,704 cows) the charge was nil. For the remaining fifteen cases (2,434 cows) the average charge works out at about 1s. 8d. per head. In eleven of these cases the charge was made on the "per test" basis, and for the remaining four

cases the charge was "per season." In the "per test" cases the season's charge was computed assuming nine periods of testing were done in all cases.

Group System.

In all but one case testing-charges were supplied, and those comprise one for "nil," three on the "per test" basis, and the remaining eighty-one on the "per season" basis. In some cases the charge per season was not a "flat rate" one, and a scale of charges in accordance with size of herd obtained. This complicated the work of computing the average charge, but the result may be accepted as reliable, seeing that the cases so represented were comparatively few in number. The average charge worked out at about 4s. 10d. per head. In those cases where independent testing officers were conducting group herd-testing work as a business enterprise the charge averaged 5s. 1d., the number of cows represented being practically 6 per cent. of the total tested twice or more under this system. In the remainder of cases the testing-work was of a co-operative nature and conducted under a self-supporting or cost basis. The most general charge was one of 5s., and 81,668 cows tested twice or more are thus accounted for, this total being almost 78 per cent. of the total cows tested under the Group system.

Table 15.—Number and Percentages of Cows and Charges classified according to System of Testing, &c., Season 1925-26. (Basis: Cows tested Twice or more.)

Particulars.	System of Testing.			
	Association.	Group.	Dairy Company.	All.
Total number of cows tested twice or more	59,345	105,227	5,204	169,776
Direct charge made—				
Number of cows	43,034	104,262	2,434	149,730
Percentage of total	72·5	99·1	46·8	88·2
Average charge per season (to nearest penny)	2s.	4s. 10d.	1s. 8d.	4s.
No direct charge—				
Number of cows	14,851	215	1,704	16,770
Percentage of total	25·0	0·2	32·7	9·9
Charge not reported, &c.—				
Number of cows	1,460	750	1,066	3,276
Percentage of total	2·5	0·7	20·5	1·9
Co-operative (direct charge made)—				
Number of cows	38,365	98,017	1,221	137,603
Percentage of total	64·6	93·2	23·5	81·1
Average charge per season (to nearest penny)	2s.	4s. 10d.	1s. 4d.	4s.
Private enterprise (direct charge made)—				
Number of cows	4,669	6,245	1,213	12,127
Percentage of total	7·9	5·9	23·3	7·1
Average charge per season (to nearest penny)	2s. 6d.	5s. 1d.	1s. 11d.	3s. 9d.

parasites are often considered to be probable carriers of the cystic stage. These tapeworms are of economic importance in their effect on the fattening process of stock for the market, and the unthriftiness of lambs and hoggets which is sometimes due to the parasites.

The domestic fowl also has its tapeworm, the slug and snail acting as intermediate hosts. It is now suspected that quite a number of adult fowls which are apparently normal die suddenly in New Zealand annually as the result of infestation with tapeworms a little larger than pin-heads, and which have encysted themselves in the intestinal wall, so setting up a condition of acute indigestion of the upper alimentary tract. Only the pig is free from the tapeworm, but often suffers as a carrier of hydatids. Not all the tapeworms known exist in New Zealand, but all those in the table, excepting the two infesting man, are known to be present.

The system of meat-inspection carried out in the large public abattoirs in New Zealand is a protection to the town dweller against infested meat for human or animal consumption, but as a further safeguard dog-owners should systematically treat their dogs for tapeworms. Once every three months house-dogs in particular, but working sheep-dogs and cattle-dogs as well, should be dosed with a tæniacide. That most often used is areca nut, 10 grains to 1 drachm, depending on the size of the dog. This should be preceded by a period of starvation for, say, twelve hours, and followed by a purgative, castor-oil being usually given. There are liquid tæniacides on the market which are beneficial and which contain a purgative, and these are usually given, being easily obtained from a chemist. No attempt should be made, however, to dose puppies for tapeworms until they are at least six months old. Puppies may have round worms, but not many tapeworms, before that time, and areca nut may prove too drastic for the young animal.

There are thus several points for the dog-owner to remember and attend to: Keep the dog away from slaughterhouses or from offal of any sort. Feed him on clean meat, or, if the meat is suspected of harbouring hydatids, it should be boiled. Do not allow the dog to be caressed unless you are sure he is clean. Dose the dog regularly every three months, and see that fæces voided following dosage are collected and burned. Thoroughly wash vegetables which are eaten raw, in case of contamination by the dog.

Rabbit Nuisance.—The annual report of the Live-stock Division for the official year 1925–26 states: "Efforts towards the destruction of rabbits have been waged with unabated energy, but, notwithstanding all the efforts put forth and the seemingly satisfactory position attained at the end of winter, the young rabbits again quickly show themselves, and the fight continues as an ever-recurring struggle. In spite, however, of the difficulties encountered we are able to report a considerable reduction in the pest as compared with the previous year. The very wet, cold season during the spring and early summer (1925) assisted considerably in the attainment of this, particularly in the Otago-Southland district, by drowning large numbers of young rabbits. Apart from this, however, the winter and spring months were not suitable for rabbit-destruction by means of poison, and very energetic measures had to be taken during the summer and autumn months to keep the rabbits in check. Rabbit Boards continue, with few exceptions, to do admirable work, and the condition of the pest in the North Island, where considerable areas are now controlled by Boards, continues to be satisfactory, demonstrating that rabbits can be effectively controlled when the co-operative spirit is dominant."

POTATO-GROWING IN NEW ZEALAND.

A STUDY OF PRODUCTION IN CANTERBURY, LOCAL CONSUMPTION, AND EXPORT: SEASON 1925-26.

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IN view of the free movement of potatoes during the past season it might be expected that the tendency would be to increase the area under this crop in the Dominion for the current season. Potatoes being a high per-acre yielding crop it is desirable that as large an area as possible be planted, but owing to their perishable nature the total yield needs to be carefully watched. Especially is this the case if the Australian market is not open. It is desirable, therefore, that the industry be reviewed from its several standpoints so that the grower may have some idea of the position. In this article first production, then local consumption, and finally export trade will be considered.

1. Production.

The following data have been obtained from the study of 130 Canterbury farms as regards the season of 1925-26. The total area in potatoes on these farms was 1,523 acres, or approximately one-fifteenth of the estimated Dominion total of 23,470 acres. The yield (table potatoes only) was 8,293 tons, or 5·44 tons per acre, approximately one-fifteenth of the average total for the past ten years. It will be appreciated, therefore, that a representative group has been studied, and the information derived may be considered reasonably sound.

DISTRICTS AND NUMBER OF FARMS IN EACH.

The location of the group units in the province is as follows :—

No. 1—5 farms : North of Ashley River—*i.e.*, Loburn, Balcairn, and Sefton districts.

No. 2—24 farms : Between Ashley and Waimakariri Rivers—*i.e.*, Rangiora, Kaiapoi, Fernside, Southbrook, Clarkville, Coutts Island, and Oxford districts.

No. 3—39 farms : Between Waimakariri and Selwyn Rivers, coast side of main railway-line — *i.e.*, Templeton, Belfast, Ladbrook's, Prebbleton, Halswell, Riccarton, Fendalton, Styx, Yaldhurst, Weedon's, Broadfield, Greenpark, Tai Tapu, Springston, and Lincoln districts.

No. 4—6 farms : As No. 3, but hill side of railway-line—*i.e.*, Darfield and Sheffield.

No. 5—15 farms : Between Selwyn and Rakaia Rivers—*i.e.*, Southbridge, Leeston, Killinchy, Dunsandel, and Hororata districts.

No. 6—8 farms : Between Rakaia and Ashburton Rivers — *i.e.*, Rakaia, Methven, Highbank, and Greenstreet districts.

No. 7—2 farms : Between Ashburton and Hinds Rivers — *i.e.*, Tinwald district.

No. 8—4 farms : Between Rangitata and Opihi Rivers—*i.e.*, Temuka district.

No. 9—5 farms : Between Opihi and Pareora Rivers—*i.e.*, Washdyke, Levels, Kingsdown, and Normanby districts.

No. 10—21 farms : Between Pareora and Waitaki Rivers—*i.e.*, Waimate, Studholme, Willowbridge, Morven, Glenavy, and St. Andrew's districts.

One farm—District not given.

YIELD BY DISTRICTS.

Of the 130 farms, 60 are above the average in yield, and 70 below, as under :—

District.	Farms above Average.	Farms below Average.	District.	Farms above Average.	Farms below Average.
No. 1	2	3	No. 8 ..	1	3
No. 2	12	12	No. 9 ..	2	3
No. 3	16	23	No. 10 ..	12	9
No. 4	3	3	Not named ..	1	..
No. 5	7	8			
No. 6	4	4			
No. 7	..	2	Totals ..	60	70

The number of farms by districts, above and below the general average, is shown in the following table :—

District.	Farms above Average.	Farms below Average.
No. 1.		
Balcairn ..	1	..
Loburn ..	..	1
Sefton ..	1	2
No. 2.		
Clarkville ..	..	1
Coutts Island ..	1	..
Fernside ..	..	1
Kaiapoi ..	1	2
Oxford ..	1	..
Rangiora ..	9	7
Southbrook ..	..	1
No. 3.		
Belfast ..	2	..
Broadfield ..	..	1
Fendalton ..	..	1
Greenpark ..	2	..
Halswell ..	1	..
Ladbrook's ..	3	..
Lincoln ..	..	1
Prebbleton ..	2	3
Riccarton ..	..	2
Springston ..	1	6
Styx	1	..
Templeton ..	1	2
Tai Tapu ..	3	1
Weedon's ..	..	3
Yaldhurst ..	..	3
No. 4.		
Darfield ..	2	2
Sheffield ..	1	1
No. 5.		
Dunsandel ..	..	3
Hororata ..	1	..
Killinchy ..	1	2
Leeston ..	1	..
Southbridge ..	4	3
No. 6.		
Greenstreet ..	2	..
Highbank ..	1	2
Methven ..	1	..
Rakaia ..	..	2
No. 7.		
Tinwald ..	..	2
No. 8.		
Temuka ..	1	3
No. 9.		
Kingsdown ..	..	1
Levels ..	1	..
Normanby ..	..	1
Washdyke ..	1	1
No. 10.		
Glenavy ..	1	1
Morven ..	1	2
Studholme ..	1	3
St. Andrew's ..	3	3
Waimate ..	3	..
Willowbridge ..	3	..

Note.—The above figures cannot be taken as indicative of the districts named in every case.

METHOD OF PLANTING.

The majority of the larger areas are planted by machine, but the plough still seems to be the most-generally-used implement. There is no appreciable difference in the cost of planting, and the fact that every farm is equipped with a plough will tend to keep it in favour for this work. The method of planting does not appear to affect the yield appreciably. Details as to method are as follows :—

		Per Cent.
Planted with plough	75 farms	= 57·7
Planted with machine	52 farms	= 40·0
Planted by hand	3 farms	= 2·3
	130	100·0

SEED.

The weight of seed planted varies from 8 cwt. to 20 cwt. per acre, the average being 16 cwt.

Cutting of seed is not practised to any extent. Planting whole seed effects a great saving of time, and where potatoes are kept for the following season's planting a few hundredweight more or less is not an important item. It is considered, however, that cutting seed tends to keep the strain pure. Having regard to the results obtained by the Department of Agriculture a few years ago in tests conducted at Ashburton with cut *versus* uncut seed, it is almost certain that the increased yield from uncut seed will more than compensate for the extra weight of seed used. On the 130 farms under review the position is as follows :—

		Per Cent.
Whole seed	123 farms	= 94·6
Cut and whole	6 farms	= 4·6
All cut	1 farm	= 0·8
	130	100·0

MANURE USED.

The use of artificial manures on the potato crop is not general. Of the 130 farms, manure was used on 53 only, or 40·8 per cent. of the whole. The average weight used was 3 cwt. per acre, the different kinds of manures being as follows :—

		Per Cent.
Potato-mixture	26 farms	= 49·1
Superphosphate	19 farms	= 35·9
Blood-and-bone	4 farms	= 7·5
Ephos phosphate	4 farms	= 7·5
	53	100·0

The use of manures was confined almost entirely to farms in the districts of poorer soil, and the yields, therefore, cannot be compared.

PLACE IN ROTATION.

It is apparent that in a rotation potatoes are quite important as a cleaning-crop after grass in the preparation of wheat land. For this reason it is difficult to estimate their value, as they may easily take the place of an expensive and comparatively unremunerative fallow.

Particulars of preceding and following crops on the farms under review are as follows :—

Preceding Crop.	Number of Farms.	Percentage of Total.	Following Crop.	Number of Farms.	Percentage of Total.
Grass	99	76·15	Wheat	81	62·31
Wheat	10	7·69	Oats	12	9·23
Oats	5	16·16	Peas	7	28·46
Peas	4		Grass	5	
Turnips	3		Mangolds ..	4	
Potatoes	2		Turnips	4	
Mangolds.. ..	2		Potatoes	3	
Tares	2		Barley	2	
Fallow	2		Onions	1	
Barley	1		Linseed	1	
			Tares	1	
			Indefinite ..	9	
Totals ..	130	100·00		130	100·00

VARIETIES GROWN.

Of the 130 farms there were sixteen definite varieties grown on 83 farms, the remaining 47 being mixed. Arran Chief holds pride of place, and as an all-round potato appears to warrant its position. An analysis of the varieties, showing their position in relation to the whole —their average yield of table potatoes and the percentage of seed and small to their total yield—is self-explanatory.

Variety.	Number of Farms.	Percentage of 130 Farms.	Number of Farms above General Average Yield.	Number of Farms below General Average Yield.	Average Yield of Table Potatoes.	Percentage of Small and Seed to Whole.
					Tons.	
Arran Chief	37	28·48	22	15	6·21	29·00
Bresee's Prolific ..	9	6·92	5	4	5·45	28·30
Magnum Bonum ..	6	4·68	4	2	6·50	23·30
Dakota*	5	3·84	1	4	4·81	32·30
Up-to-Date	5	3·84	3	2	6·80	32·50
Aucklanders* ..	4	3·07	1	3	4·34	36·75
Various definite varieties	17	13·07	7	10	5·60	34·80
Mixed	47	36·10	17	30	6·21	29·00
Totals	130	100·00	60	70	..	..

* Dakotas and Aucklanders are generally claimed to produce a very low percentage of seed potatoes; the farms studied were probably not representative of these varieties.

So far as the named varieties are concerned, there are not enough of any one to make a fair comparison with Arran Chief. Magnum Bonum has yielded better, and has a lower percentage of small potatoes. It will be noticed that "mixed" varieties equal Arran Chief in both yield and percentage of small, a number of very high producers being in this category. Where mixed varieties are classified, Arran Chief appears twelve times, and is therefore associated with a large

proportion of this class. Various definite varieties include the following: Gold Coin (3), British Queen (3), Britain's Best (2), Gamekeeper (2), Lady Fife (2), Endurance (1), Northern Star (1), Sutton's Abundance (1), King Edward (1), Early Regent (1).

On the 130 farms the average cost of ploughing, disking, grubbing, harrowing, rolling, ridging, planting, cultivating, and moulding works out at £4 7s. 6d. per acre. Digging, sorting, bagging, and cartage to sheds or pits averages £1 2s. 6d. per ton. If pitted and rebagged the added expense is 13s. 9d. per ton, and average cartage to rail 5s. 8d. per ton.

SUMMARY OF PRODUCTION POSITION.

If an arbitrary figure of £2 5s. per acre is set for seed (16 cwt. average seed used), the production position may be summarized as follows:—

	Totals.	Average per Farm.
Acreage of farms studied..	24,416 acres	187·815 acres.
Acreage under potatoes	1,523 ,,	11·715 ,,
Yield	11,903 tons	91·561 tons.
Table potatoes	8,293 ,,	63·792 ,,
Seed potatoes	2,639 ,,	20·300 ,,
Small potatoes	971 ,,	7·469 ,,

Yield per acre: Table potatoes, 5·445 tons; seed potatoes, 1·740 tons; small potatoes, 0·630 ton. Percentage seed and small (of whole crop), 30·329; percentage seed only (of table and seed), 24·140.

Table potatoes: Sold, 7,062 tons (from 124 farms); exported, 3,445 tons (from 83 farms); sold locally, 3,617 tons (from 88 farms); on hand, 1,231 tons (from 82 farms).

Cost f.o.r. off forks (sacks extra): Per acre, £20 10s.; per ton, £2 17s. 1d.

Cost f.o.r. from pits (sacks extra): Per ton, £3 10s. 10d.

Average price per ton received for 7,062 tons sold, £4 11s. 4d.

Value of table potatoes per acre at £4 11s. 4d. per ton, £24 17s. 4d.

Profit per ton on table potatoes if seed sold at cost, £1 14s. 3d.

Profit per acre if all potatoes sold, £9 6s. 6d.

The marketing of the crops from the farms studied (10th September last) is as follows:—

Farms holding all their potatoes	6
Farms selling for export only	36
Farms selling for local consumption only	41
Farms selling for export and local consumption	47
	130

It will be seen from the foregoing data that the cost of producing potatoes averages £2 17s. 1d. per ton (table and seed only considered). The cost of the 16 cwt. of seed used per acre is therefore £2 5s. 7d. instead of £2 5s.

The average yield of table tubers is 5·445 tons per acre, giving a return of £24 17s. 4d. per acre, and 1·74 tons of seed potatoes, which at cost price would return £4 19s. 2d. per acre, giving a total value per acre of £29 16s. 6d., or a profit of £9 6s. 6d.

It must be appreciated, however, that to realize this profit the whole of the seed potatoes need to be sold at not less than £2 17s. 1d. per ton, and table potatoes at an average price of £4 11s. 4d. Should the price obtained drop below this level, profit will be reduced accordingly.

On 82 farms an average of 15 tons of table potatoes remains on hand. These will cost 13s. 9d. per ton for re-sorting and bagging—to say nothing of losses in re-sorting. Therefore on these farms the costs will be increased by approximately 18s. per acre on the whole area.

If £4 11s. 4d. per ton be taken as a standard price for table potatoes, and £2 17s. 1d. for seed potatoes, then 35 of the 130 farms, or 26 per cent., show an actual loss on the crop. Many of the low per-acre producing farms have sold at a price higher than the average, or have produced at a lower cost, so actually the farms selling at a loss represent less than 26 per cent.

Table potatoes, then, cost approximately £3 per ton to produce and deliver f.o.r. (sacks extra). On the past season's standard of production some farmers may, if doing their own work, sell at that price and make wages. But it is not safe to work on this margin, as a very small percentage of waste in pitted or in seed potatoes may easily result in a loss. At £4 11s. 4d. per ton the majority of the farms producing less than 4 tons of table potatoes per acre are actually not making wages.

Low per-acre yields have the added disadvantage of giving a high proportion of seed and small potatoes. On the farms under review the percentage for those above the average yield is 25·9, whereas for those below the average it is 34·7. In other words, the smaller the crop the higher is the proportion of small potatoes.

Reduced to a debit and credit account the position is as follows :—

Costs and Proceeds of 1 Acre of Potatoes, Season 1925–26.

Dr.	£	s.	d.	Cr.	£	s.	d.
To Ploughing	1	4	9	By Table potatoes, 5·44 tons at £4 11s. 4d. ..	24	17	4
Disking	0	7	0	Seed potatoes, 1·74 tons at £2 17s. 1d. ..	4	19	2
Grubbing	0	6	9				
Harrowing	0	4	0				
Rolling	0	3	0				
Planting	1	1	0				
Cultivation	0	15	0				
Moulding	0	6	0				
Digging and carting to sheds (£1 2s. 6d. per ton for 7·8 tons) ..	8	15	6				
Cartage to rail (5s. 8d. per ton)	2	4	0				
Seed potatoes, 16 cwt. ..	2	5	0				
Manure	0	8	0				
Land (average £36 per acre at 6 per cent.) ..	2	2	0				
Rates, taxes, and upkeep	0	8	0				
Net profit per acre ..	9	6	6				
	£29	16	6		£29	16	6

The above is worked on the average of the 130 farms. For that reason it may be difficult to reconcile some of the figures. Where a farmer is doing his own work the preparation for potatoes fits in very well with his other activities, and provides occupation for his team which otherwise may be idle. On this account it may be claimed that the actual cost is less than shown above. On the other hand,

where dirty land is being prepared for potatoes a great many workings may be given. This perhaps applies in the majority of cases on heavy land.

2. Local Consumption.

Our annual potato crop is disposed of through the following channels: Table use locally, export for table use, as seed for the following season, as feed for stock, or as waste. The small potatoes are seldom wholly consumed, and may be looked upon as waste, representing 8·125 per cent. of the total yield. Seed potatoes, representing 24·14 per cent. of the remainder, are used partly as seed and partly for table purposes. In the past season the average production per acre of seed potatoes was in the vicinity of 1·74 tons, and as the average weight of seed planted is 16 cwt., 18·8 cwt. per acre remained for human consumption.

The Government Statistician gives in the Official Year-book the acreage and total yield of potatoes. It must be clearly understood that these figures apply to potatoes grown outside boroughs, and do not account for small garden plots grown for family use. As each year's figures are tabulated on the same basis, however, they are quite comparable.

Taking an average of the years 1917 to 1925 the position is as follows:—

Area (average for nine years)	22,093 acres.
Production (total average for nine years) ..	118,311 tons.
Exports (total average for nine years) ..	1,613 tons.
Imports (total average for nine years) ..	172 tons.

Consumption, then, takes place as follows:—

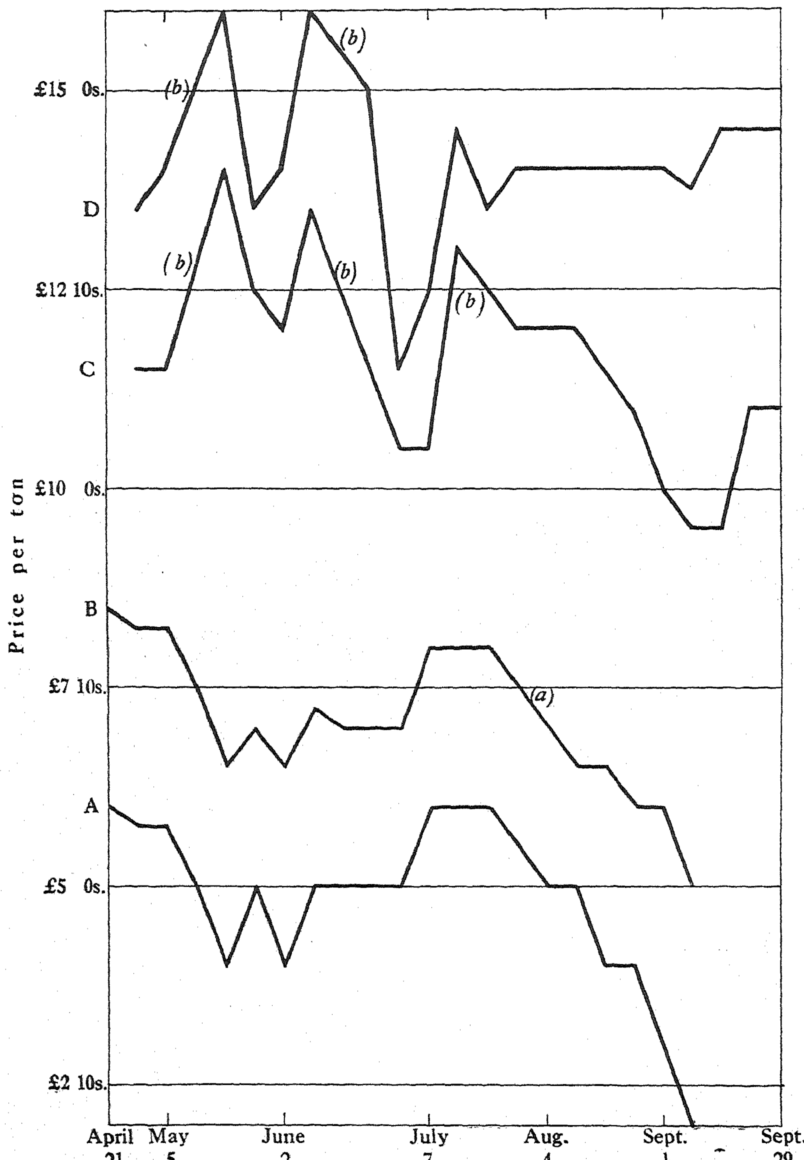
	Tons.	Tons.
Total crop	..	118,311
Small potatoes (8·125 per cent. of whole) ..	9,613	
Used for seed	17,674	
Exported	1,613	
Human consumption in Dominion	89,411*	
		118,311

* Locally grown, 89,411 tons; imported, 172 tons.

Calculated on the average estimated population, this gives a per-head consumption of 157 lb. per annum. If the estimated yield for the past season is reliable there is likely to be a surplus.

3. Export Trade.

Up to 1st October this year the amount of potatoes exported is in the vicinity of 16,500 tons. Had there not been such a demand from Australia the position would have been very serious. On the information available it is impossible to say what the Australian market is likely to be for the present season (in 1927). For the last seven years (1918–19 to 1924–25) the area planted in the Australian States has fluctuated between 110,000 and 150,000 acres, with an average of 131,000 acres. The yield has varied from 260,000 to 448,000 tons, or an average of 345,000 tons. For ten years previous to 1923 the average yield of potatoes in the Australian States was 2·52 tons per acre. The Commonwealth Year-book does not indicate whether this is total yield or table potatoes only. It is quite



GRAPH SHOWING POTATO-PRICES AT CERTAIN POINTS, SEASON 1925–26.

A. Prices to farmers, f.o.r. country stations, Canterbury (sacks extra).
B. Prices to merchants, f.o.b., s.i., Lyttelton–Australia trade.
C. Selling-price of New Zealand potatoes on Sydney market.
D. Selling-price of Tasmanian potatoes on Sydney market.

NOTES.—(a) No buyers; (b) prices not available.

apparent that with a low average yield good seasons may influence the total crop enormously. Between 1919 and 1925 Australia's imports have only once exceeded exports—namely, in 1920, when there was a surplus of 1,100 tons in favour of imports. It is estimated that the annual consumption per head in Australia is 126 lb. Allowing for seed reserve, it would appear that Australia needs approximately 360,000 tons per year.

The accompanying graph shows the relative prices prevailing at different dates. It will be seen that the price f.o.r. country stations, and the price f.o.b., s.i., Lyttelton, maintain a fairly uniform position. The expenses incurred by the local merchant, including sacks, railage, wharfage, grading, branding, and brokerage, amount to £1 7s. per ton. The price f.o.b., s.i., Lyttelton, and that realized for New Zealand potatoes in Sydney shows acute differences. The expense incurred by the Sydney merchants in freight, duty, Sydney inspection, harbour dues, brokerage, and incidentals is approximately £3 18s. 6d.

Tasmanian potatoes maintain a higher level than New Zealand tubers on the Sydney market. It may appear at first glance as though both local and Sydney merchants have been making excessive profits, but really such has not been the case. It must be realized that these are the prices offered at comparable dates, but business may not have been done. Most of the potatoes for export were bought forward at high prices, and it is possible that merchants actually lost on the transaction.

The fall in prices from last July onwards is traceable to (*a*) appreciation of the fact that a carry-over was certain, and (*b*) speculation. To what extent overselling on the part of speculators was responsible for the drop it is difficult to say, but it is quite conceivable that overselling at prices below the ruling price must force the market down when a surplus is known to exist. A drop in prices was inevitable with such an oversupply. The exploitation of the market by keen judges of the position tends to flatten out fluctuations in price rather than allow the fall to be sudden and drastic at perhaps a later date; but which method is best in the interests of the grower is a question.

Summary and General.

It appears that the average potato-grower of Canterbury can produce potatoes at approximately £3 per ton if the season is favourable. If the Australian market is closed an area of 22,000 acres will, on the average, supply local demands.

The cost of growing potatoes and putting them on the Sydney market is at present £8 5s. per ton. Allowing 10s. per ton for local merchant's margin and the same for the Sydney merchant, it would appear that New Zealand potatoes may be put on the Sydney market at approximately £9 5s. per ton. The farmer, however, should be allowed at least 15s. per ton above cost of production to cover possible wastage, which brings the price at which New Zealand can enter the market to £10 per ton.

A study of the position suggests that a considerable amount of experimental work needs doing on the potato crop, especially with regard to pure-seed and variety trials, the value of different manures, and the effect on the next crop in the rotation.

PUWERA GUM-LAND EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1925–26.

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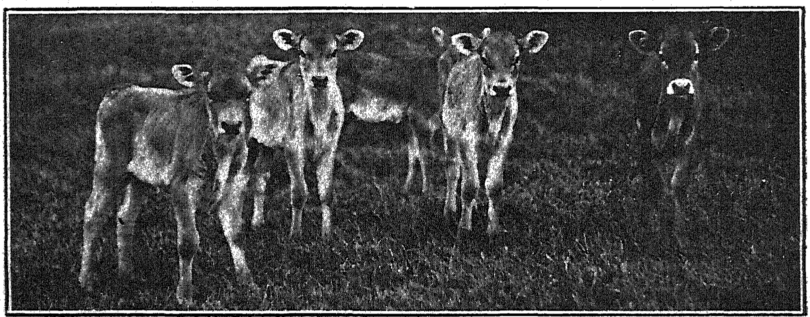
DAIRYING.

THE feature of greatest interest to all concerned with the development of the clay gum-lands since the establishment of the Puwera experiments is probably the first year's experience with the small dairy herd milked on the farm last season. All the nine heifers and five cows—all grade Jerseys—were tested, and the average test, based on figures supplied by the Whangarei Co-operative Dairy Company, worked out at 220 lb. of butterfat per head. The carrying-capacity of the land proved to be slightly over 2 acres per beast. These results in the first year of dairying are regarded as very satisfactory, considering the conditions which had to be contended with. Most of the animals calved between the middle of September and early October, two coming in as late as November. The late start was therefore an initial handicap.

Weather conditions throughout the season were unfavourable. The spring was late and characterized by cold winds and squalls, which were trying to the dairy stock. When the weather did take up in December it set in hot and dry. The continued dry spell seriously hampered the water-supply, which was drawn from a creek below the dairy-shed. The hill paddocks are watered from a surface spring, which, unfortunately, dried up for the first time since our occupation of Puwera. According to old gum-diggers near-by who have used the same spring, this was its first failure in fifty years. There was plenty of feed on the pastures—in fact, one could not help but notice the contrast presented by the greenness and succulence of the grass on Puwera and that seen on the volcanic lands when the summer drought had browned the surrounding country. But though the pastures supplied adequate feed, and this was supplemented by green fodder crops and soft turnips, the milk-yield went down even in December. The cause was clearly lack of sufficient water, an adequate supply of which is, of course, a prerequisite to successful dairying.



SOME OF THE YOUNG DAIRY STOCK AT PUWERA FARM.

Two members of the herd tested last season have been culled, and six good-type Jersey grade heifers added, together with three extra cows, making the herd total for the current season twenty-one. The herd could be further strengthened if the water-supply were better.*

BREAKING-IN OF VIRGIN AREA.

Another feature of interest in the year's work was the breaking-in of a new area of 30 acres of virgin gum-land of an undulating to hilly nature. This is situated on the north-western side of the creek which divides the farm. The preliminary cultivation of the new area was similar in general to that which gave such good results on the older part of the farm, but was modified in order to reduce the number of operations performed and the period for which the land lay in fallow, thereby saving time and cheapening the breaking-in process. The new area was ploughed once only, instead of twice as with older fields. The length of the fallow was not longer than six months, which represented half the usual period allowed heretofore. The area was not subsoiled. The usual surface cultivation was followed with a liberal use of the spring-tine cultivators, in addition to disks, to secure good tilth just below the surface and a somewhat cloddy upper layer—an essential mechanical condition to prevent a hard crust forming on top of the stiff soil.

The grass-seed mixture (consisting mainly of rye-grasses, paspalum, crested dogstail, and clovers, also including ½ lb. of subterranean clover) and the manuring were substantially the same as on the best of the fields on the older area, but liming was reduced to 10 cwt. of ground limestone per acre, and a portion received no lime. The take of grass was quite satisfactory, and the pasture throughout the spring presented the appearance of being most promising. It remains to be seen whether the shorter and cheaper process produces results equal to those attained on the older fields. If it does, then it will considerably reduce breaking-in costs.

PASTURE GRAZING THROUGHOUT THE SEASON.

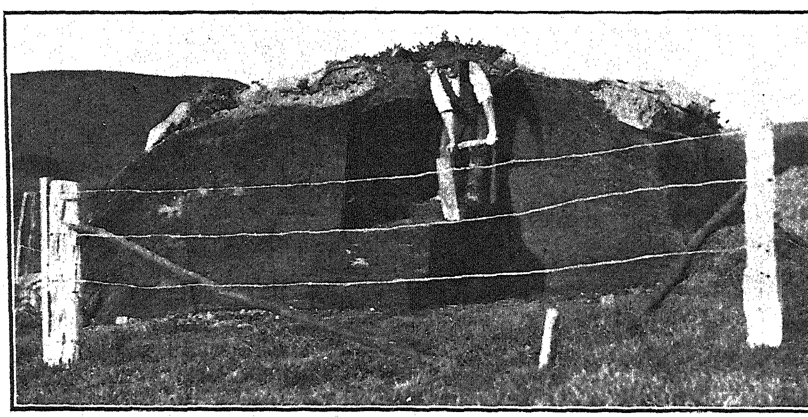
The pastures are, of course, the mainstay of Puwera. All the known good methods of pasture-management are employed to secure the most profitable results. Top-dressing; tripod-chain harrowing; mowing, to prevent the pastures "getting away"; small paddocks, to allow of alternate grazing and spelling; feeding out roots and fodders on the upland pastures from crops grown on the flat—these in the main are the chief features of the pasture-management. Annual top-dressing, principally with basic slag at the rate of 2½ cwt. to 3 cwt. per acre, is practised. First-class pastures are thus maintained by practices used in almost every district in New Zealand where dairying is intensive, and, moreover, they are within the means of any ordinary farmer. Perennial rye-grass and clover are the main constituents of the pastures.

Paspalum as a dominant constituent only shows up prominently in December and afterwards. It is a fact worthy of attention that where the pastures consist chiefly of rye-grasses, paspalum, and clovers, and are top-dressed regularly each season, the consistent vigorous growth of rye-grass is actually tending to hold paspalum in check. In fact,

* Authority has now been given for an expenditure of £100 on a bore for water.

as just mentioned, from early August till December the pastures are to all appearances rye-grass and clover pastures; but when cut for hay or silage, or grazed heavily, paspalum then shows up prominently and supplies the chief feed till May, and in some seasons even well into June. Thus a long season of grazing is provided by such a succession if the management includes top-dressing and the other practices already referred to. On Field 6 there is still a vigorous growth each season of Western Wolths rye-grass before the paspalum comes away.

Another matter which receives attention at Puwera is very light stocking in the spring of pastures sown in the previous autumn. It is a practice which encourages deep rooting, and this, added to the benefits accruing from phosphatic manuring, gives the grasses the power to withstand continued dry weather, to remain succulent and green when other pastures not so treated are dry, and to retain the close turf so essential to a good sward more or less free of weeds. Moreover, the permanence of such a sward is influenced in the right direction by a little nursing in the early life of the pasture. Modern research bears out the soundness of this practice.



SILAGE AT PUWERA.

For cutting out blocks of silage from the stack a knife with each side of the broad V-shaped point sharpened is used, allowing easy entry.

SUPPLEMENTARY FEED.

With the mild winters obtaining in North Auckland, and the pasture-management practised at Puwera, a long period of productive grass-growth is secured. The need, therefore, for special crops becomes less than farther south. The Puwera pastures are pieced out by saving hay and silage from the spring surplus. This practice, where paspalum forms the chief feed after December, is very beneficial to the pasture, as short, quick-growing paspalum and clovers form ideal feed for dairy cows at that time of the year. It was a notable fact at Puwera last season that the cows milked better on the paspalum field, which was cut for silage in early January, than when fed with millet or, later, green maize and sorghum. We find, however, at Puwera that it pays to have maize and sorghum as a standby because of the high yield per

acre of green feed from these crops. The amount of hay per dairy cow used at Puwera last season was 15 cwt., and we had 17½ tons of matured silage cut from 8 acres. At a ration of about 40 lb. daily per cow the silage provided the herd with two months' supply. Only one-third of the stack was used in the early spring, and the remainder is being held for a possible dry spell in the autumn.

Mangolds and swedes, together with hard turnips sown in February on oat stubble, provide winter roots, which are fed with hay. The only other supplement to the pasture is green oats, fed in the early spring before the pasture begins to move appreciably. A good combination used at Puwera was 1½ bushels of Algerian oats sown with 25 lb. of grass-pea and 4 lb. of crimson clover. The crop was cut for hay after several grazings. Oats are grown each season for chaff to supply horse-feed.

With the use of paspalum and kikuyu-grass for late summer and autumn feed, the area devoted to special crops at Puwera is greatly reduced. Other than a small area of maize and sorghum, together with the silage already referred to, no extra cropping should be needed. The problem for the average North Auckland farmer, especially on the better soils, should be even easier of solution than at Puwera.

KIKUYU-GRASS.

After about three years the kikuyu pasture on Field 2 became sod-bound. The mass of turf was turned under by the mouldboard plough in the middle of August, received three strokes of the disk harrows early in September, and was sown with the following seed mixture: Italian rye-grass, 12 lb.; red clover, 6 lb.; Lotus major, 1 lb. per acre. Superphosphate, 2 cwt., and blood-and-bone, 1 cwt., per acre, were applied with the seed. It is expected that this procedure will rejuvenate the kikuyu-grass and at the same time provide a temporary grazing resulting from the mixture sown.

The amount of feed provided by the kikuyu-grass during the three seasons from the original sowing was beyond expectation. Kikuyu, when used with red clover or Lotus major, each of which is able to keep pace with kikuyu in the summer, when the growth of the latter is very rapid, makes a good sward. White clover, on the other hand, is smothered unless the pasture is kept short by very heavy stocking, in which case the kikuyu and white-clover combination is an excellent one, as seen at Puwera where a plot was so treated. In fact, it is rather interesting to record that no white clover or manure was sown, but the kikuyu merely kept grazed hard on a small plot of pure danthonia where the kikuyu had been introduced. On the kikuyu plot the white clover has come in voluntarily, and the combination forms a green succulent sward in contrast to the adjoining danthonia, which is dry and uninviting and with no white clover present.

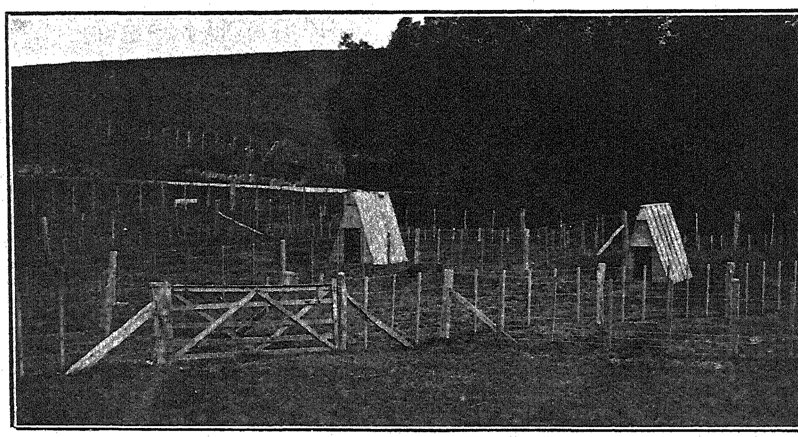
Where a few acres of kikuyu were put down in Field 4 (by broadcasting shoots chopped up with a sharp spade) on a surface only double-disked the grass has taken rather well. Combined with rye-grass and clovers the sward, which was manured with phosphate, is now providing good feed. Probably a better method of preparing the kikuyu would be to put the jointed stems loosely through a chaffcutter, allowing for a

long cut, and then broadcast on a disked surface. A small seeding of rye-grasses and clovers with Lotus major should be added.

As our experience grows with kikuyu-grass it only confirms our early results—that kikuyu has proved a valuable introduction and has added a further useful species of economic value to our grasslands, especially on areas where the summer is warm and dry and English grasses become unproductive. Like paspalum, it is a very vigorous grower and is highly productive, but, as it has not seeded so far, it can be more easily controlled.

OPEN-AIR PIG-RAISING.

Two pedigree Berkshire sows were purchased at Ruakura State Farm and were put at Puwera in the early spring. They are Dominion Mira and Dominion Palmdale—maiden sows served by Dominion Scholar, one of the best Berkshire sires at Ruakura. One has farrowed and the other is due shortly. The pigs are run on the



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COCKSFOOT FOR SEED.

This stand is now six years old, having been sown in October, 1921, in rows 24 in. apart. The yield of seed last harvest was very poor, and the stand would appear to have outlived its usefulness. The area will therefore be surface-sown with rye-grass and clover, and utilized for hay or pasture.

LUCERNE STANDS.

Grazing trials of lucerne have been continued, affording conclusive evidence of the value of this crop under Canterbury conditions. Although certain areas have been grazed on almost every occasion since they were sown in March, 1921, there is very little evidence of deterioration due to grazing, but nevertheless such evidence is directly proportionate to the extent of grazing carried out.

Lucerne is no exception to the general rule governing pasture, in that its productiveness is regulated by seasonal conditions and the class of land on which it is grown. Nevertheless, our present experience would indicate that once established it carries so much more stock than anything else of a permanent nature could do on the medium lands of Canterbury that every endeavour should be made by farmers to establish larger areas for grazing purposes. The following grazing returns afford some indication of the carrying-capacity of the lucerne stands at Ashburton :—

Area of 20 Acres.

9 acres divided into three blocks, grazed as follows: Sept. 11–Dec. 31, 120 hoggets for 112 days; Jan. 1–18, 112 hoggets for 18 days; Feb. 4–12, 127 hoggets for 9 days.

11 acres reserved for hay; cut twice, yielding 29 tons of hay.

Thereafter the total area of 20 acres grazed as follows: Feb. 12–16, 254 sheep for 4 days; Feb. 17–Mar. 14, 208 sheep for 26 days.

The grazing of this area is equivalent to $3\frac{1}{5}$ sheep per acre per annum and 29 tons of hay for winter feeding. Allowing $2\frac{1}{2}$ lb. lucerne chaff per head per day during the winter, this area of 20 acres would carry an equivalent of 128 sheep for six months in summer and 140 sheep during the six winter months (supplemented by winter grazing).

Area of 13 Acres.

Block 1, grazed as follows: Sept. 25–Oct. 8, 168 sheep for 13 days; Oct. 21–Nov. 5, 168 sheep for 15 days; Nov. 17–23, 53 sheep for 6 days; Nov. 24–28, 161 sheep for 5 days; Nov. 29–Dec. 12, 38 sheep for 14 days; Dec. 28–31, 51 sheep for 3 days.

Block 2, grazed as follows: Sept. 30–Oct. 7, 200 sheep for 7 days; Oct. 8–17, 171 sheep for 10 days; thereafter closed and cut once, yielding 8 tons of hay.

Thereafter the total area of 13 acres grazed as follows: Jan. 31–Feb. 17, 190 sheep for 17 days; Mar. 3–20, 150 sheep for 17 days; Mar. 23–28, 120 sheep for 5 days.

The grazing of this area represents a carrying-capacity of 3⅓ sheep per acre per annum, and a yield of 8 tons of hay for winter feed. Allowing 2½ lb. of lucerne chaff per head (supplemented with winter grazing), the carrying capacity of the 13 acres is equivalent to 87 sheep for the six summer months and 40 sheep for the six winter months.

In connection with the feeding of lucerne chaff Mr. McKay reports: "Our experience on the farm has been confined to hand feeding during actual winter months only, when it was found that at least ten ewes per acre could be carried in good health on light land with a supplementary ration of 2½ lb. of lucerne chaff per sheep per day. We cannot at present say for just how long this, or heavier stocking, could be carried on without ill effects to the health of the sheep where lucerne chaff alone is being fed."

PURE LINES OF SEED.

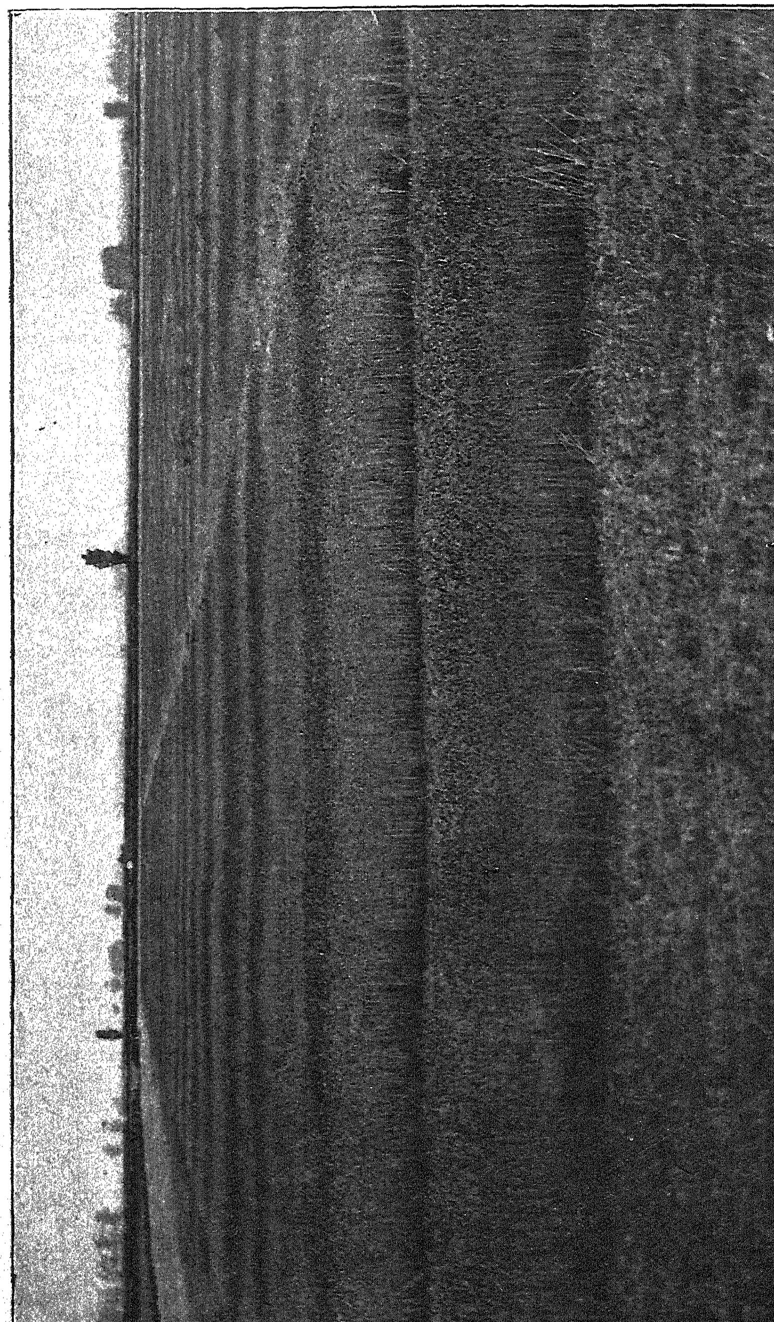
The pure line of Dreadnought wheat selected in the preceding season by Mr. McKay (*Journal*, September, 1925, page 153) has been sown in an increase plot, and the produce from this should form a valuable nucleus in pure-seed production for the farmers of North Otago. Mr. McKay has also raised by careful selection pure lines of the three most important varieties of potatoes in Canterbury—namely, Arran Chief, Bresee's Prolific, and Dakota. It is intended to pay close attention to this aspect of the work in future.

WHEAT VARIETY TRIAL.

A continuation was made of the trial of wheat varieties commenced in the preceding season, each variety again being checked against College Hunter's as the standard. The Hunter's used in the season under review was obtained direct from Lincoln College, having been grown there in the previous season. The product of this will be used as the control variety in the future.

Six replications of each variety were sown with control of College Hunter's immediately alongside each varietal plot. This was obtained by sowing every third plot with College Hunter's. Each strip was divided into three at harvest, giving up to eighteen comparisons with the standard.

The unusually wet season caused extreme caking of the surface of the ground, and this crop, like many autumn- and winter-sown ones in the same period, suffered very badly, as will be seen from the extremely poor yields. So bad was the effect of the wet that portion of one end of the plots had to be eliminated from the yield-determination.



PORTION OF WHEAT VARIETY PLOTS, ASHBURTON EXPERIMENTAL FARM, SEASON 1925–26.

[*Photo by F. E. Ward.*

As in the previous year, all varieties were sown at a rate calculated to give the same number of seeds per acre as 90 lb. of College Hunter's. To arrive at the required quantity of seed for each variety a number of 100-grain samples were weighed and the mean calculated; hence the number of grains per unit weight was arrived at.

Table 1.—Yield of Wheat Varieties, 1926 Harvest.

Area of individual plot = $\frac{1}{68}$ acre. > = greater than (all tables).

Variety.	Number of Paired Plots compared.	Yields per Acre.			Odds.	Date sown in June.*	Date harvested.
		Variety.	College Hunter's.	Difference (+) in favour of College Hunter's or (−) of Variety.			
		Bushels.	Bushels.	Bushels.			
Velvet (Ngapara)	14	13·9	12·7	−1·2	210	26th	8/2/26
Velvet (College) ..	13	14·1	13·5	−0·6	N.S.†	25th	8/2/26
Essex Conqueror..	17	13·9	14·0	+0·1	N.S.	25th	9/2/26
Goldberry ..	17	13·0	13·5	+0·5	N.S.	27th	16/2/26
Solid-straw Tuscan	12	13·6	14·7	+1·1	N.S.	24th	9/2/26
Red Fife ..	16	12·1	13·8	+1·7	180	26th	26/1/26
White-straw Tuscan	15	11·4	13·7	+2·3	950	26th	29/1/26
Yeoman ..	17	11·3	14·3	+3·0	850	26th	16/2/26
Marquis ..	15	12·0	15·2	+3·2	>9999	25th	26/1/26
Zealand.. ..	16	10·0	14·6	+4·6	>9999	27th	29/1/26
Major	16	9·5	14·4	+4·9	>9999	26th	26/1/26
Queen Fan ..	17	8·7	14·6	+5·9	>9999	25th	26/1/26
Queen Fair ..	15	7·7	14·6	+6·9	>9999	25th	26/1/26

* College Hunter's sown 23rd June. † Where the letters "N.S." are inserted in this and other tables the difference is non-significant—that is, the chances are less than 30 to 1 in its favour.

A comparison with the results of the preceding season will show that several varieties which proved superior in the 1925 harvest yielded very poorly under the adverse conditions met with in that of 1926. While several varieties have held their own with College Hunter's, only Velvet (Ngapara) has proved superior by a small amount.

WHEAT MANURIAL TRIAL.

An experiment on the manuring of wheat was conducted with the following treatments. The paddock had previously been in grass for four or five years.

	Per Acre.
(1.) Control (no manure)	..
(2.) Superphosphate (42/44 per cent.), 104 lb.; and sulphate of ammonia (20 per cent. nitrogen), 82 lb.	186 lb.
(3.) Ammo-Phos (20/20)*	100 lb.
(4.) Super	104 lb.
(5.) Super, 250 lb.; and sulphate of potash (48 per cent. K_2O), 56 lb.	306 lb.
(6.) Super	250 lb.
(7.) Ammo-Phos (13/48)*	100 lb.
(8.) Super, 250 lb.; and sulphate of ammonia, 53 lb. ..	303 lb.
(9.) Super, 250 lb.; sulphate of potash, 56 lb.; and sulphate of ammonia, 53 lb.	359 lb.

* Ammo-Phos is in two grades: that described as 20/20 contains 20 per cent. ammonia (= 16·4 per cent. nitrogen) and 20 per cent. phosphoric anhydride; the 13/48 grade contains 13 per cent. ammonia (= 10·7 per cent. nitrogen) and 48 per cent. phosphoric anhydride.

PUWERA GUM-LAND EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1925–26.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, Auckland.

DAIRYING.

THE feature of greatest interest to all concerned with the development of the clay gum-lands since the establishment of the Puwera experiments is probably the first year's experience with the small dairy herd milked on the farm last season. All the nine heifers and five cows—all grade Jerseys—were tested, and the average test, based on figures supplied by the Whangarei Co-operative Dairy Company, worked out at 220 lb. of butterfat per head. The carrying-capacity of the land proved to be slightly over 2 acres per beast. These results in the first year of dairying are regarded as very satisfactory, considering the conditions which had to be contended with. Most of the animals calved between the middle of September and early October, two coming in as late as November. The late start was therefore an initial handicap.

Weather conditions throughout the season were unfavourable. The spring was late and characterized by cold winds and squalls, which were trying to the dairy stock. When the weather did take up in December it set in hot and dry. The continued dry spell seriously hampered the water-supply, which was drawn from a creek below the dairy-shed. The hill paddocks are watered from a surface spring, which, unfortunately, dried up for the first time since our occupation of Puwera. According to old gum-diggers near-by who have used the same spring, this was its first failure in fifty years. There was plenty of feed on the pastures—in fact, one could not help but notice the contrast presented by the greenness and succulence of the grass on Puwera and that seen on the volcanic lands when the summer drought had browned the surrounding country. But though the pastures supplied adequate feed, and this was supplemented by green fodder crops and soft turnips, the milk-yield went down even in December. The cause was clearly lack of sufficient water, an adequate supply of which is, of course, a prerequisite to successful dairying.

SOME OF THE YOUNG DAIRY STOCK AT PUWERA FARM.

Two members of the herd tested last season have been culled, and six good-type Jersey grade heifers added, together with three extra cows, making the herd total for the current season twenty-one. The herd could be further strengthened if the water-supply were better.*

BREAKING-IN OF VIRGIN AREA.

Another feature of interest in the year's work was the breaking-in of a new area of 30 acres of virgin gum-land of an undulating to hilly nature. This is situated on the north-western side of the creek which divides the farm. The preliminary cultivation of the new area was similar in general to that which gave such good results on the older part of the farm, but was modified in order to reduce the number of operations performed and the period for which the land lay in fallow, thereby saving time and cheapening the breaking-in process. The new area was ploughed once only, instead of twice as with older fields. The length of the fallow was not longer than six months, which represented half the usual period allowed heretofore. The area was not subsoiled. The usual surface cultivation was followed with a liberal use of the spring-tine cultivators, in addition to disks, to secure good tilth just below the surface and a somewhat cloddy upper layer—an essential mechanical condition to prevent a hard crust forming on top of the stiff soil.

The grass-seed mixture (consisting mainly of rye-grasses, paspalum, crested dogstail, and clovers, also including ½ lb. of subterranean clover) and the manuring were substantially the same as on the best of the fields on the older area, but liming was reduced to 10 cwt. of ground limestone per acre, and a portion received no lime. The take of grass was quite satisfactory, and the pasture throughout the spring presented the appearance of being most promising. It remains to be seen whether the shorter and cheaper process produces results equal to those attained on the older fields. If it does, then it will considerably reduce breaking-in costs.

PASTURE GRAZING THROUGHOUT THE SEASON.

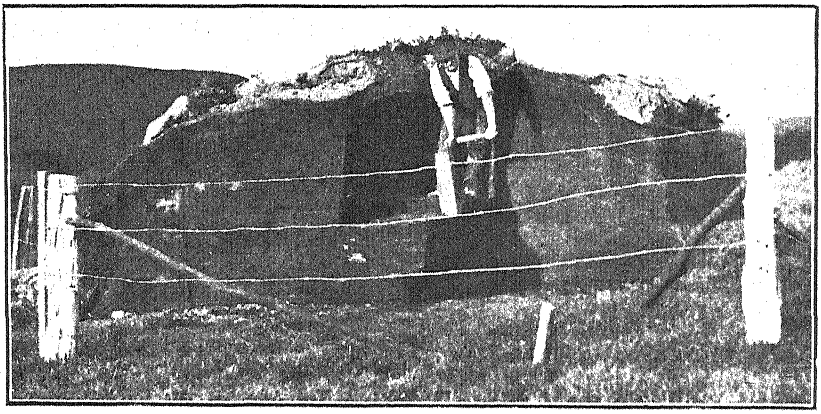
The pastures are, of course, the mainstay of Puwera. All the known good methods of pasture-management are employed to secure the most profitable results. Top-dressing; tripod-chain harrowing; mowing, to prevent the pastures "getting away"; small paddocks, to allow of alternate grazing and spelling; feeding out roots and fodders on the upland pastures from crops grown on the flat—these in the main are the chief features of the pasture-management. Annual top-dressing, principally with basic slag at the rate of 2½ cwt. to 3 cwt. per acre, is practised. First-class pastures are thus maintained by practices used in almost every district in New Zealand where dairying is intensive, and, moreover, they are within the means of any ordinary farmer. Perennial rye-grass and clover are the main constituents of the pastures.

Paspalum as a dominant constituent only shows up prominently in December and afterwards. It is a fact worthy of attention that where the pastures consist chiefly of rye-grasses, paspalum, and clovers, and are top-dressed regularly each season, the consistent vigorous growth of rye-grass is actually tending to hold paspalum in check. In fact,

* Authority has now been given for an expenditure of £100 on a bore for water.

as just mentioned, from early August till December the pastures are to all appearances rye-grass and clover pastures; but when cut for hay or silage, or grazed heavily, paspalum then shows up prominently and supplies the chief feed till May, and in some seasons even well into June. Thus a long season of grazing is provided by such a succession if the management includes top-dressing and the other practices already referred to. On Field 6 there is still a vigorous growth each season of Western Wolths rye-grass before the paspalum comes away.

Another matter which receives attention at Puwera is very light stocking in the spring of pastures sown in the previous autumn. It is a practice which encourages deep rooting, and this, added to the benefits accruing from phosphatic manuring, gives the grasses the power to withstand continued dry weather, to remain succulent and green when other pastures not so treated are dry, and to retain the close turf so essential to a good sward more or less free of weeds. Moreover, the permanence of such a sward is influenced in the right direction by a little nursing in the early life of the pasture. Modern research bears out the soundness of this practice.



SILAGE AT PUWERA.

For cutting out blocks of silage from the stack a knife with each side of the broad V-shaped point sharpened is used, allowing easy entry.

SUPPLEMENTARY FEED.

With the mild winters obtaining in North Auckland, and the pasture-management practised at Puwera, a long period of productive grass-growth is secured. The need, therefore, for special crops becomes less than farther south. The Puwera pastures are pieced out by saving hay and silage from the spring surplus. This practice, where paspalum forms the chief feed after December, is very beneficial to the pasture, as short, quick-growing paspalum and clovers form ideal feed for dairy cows at that time of the year. It was a notable fact at Puwera last season that the cows milked better on the paspalum field, which was cut for silage in early January, than when fed with millet or, later, green maize and sorghum. We find, however, at Puwera that it pays to have maize and sorghum as a standby because of the high yield per

acre of green feed from these crops. The amount of hay per dairy cow used at Puwera last season was 15 cwt., and we had $17\frac{1}{2}$ tons of matured silage cut from 8 acres. At a ration of about 40 lb. daily per cow the silage provided the herd with two months' supply. Only one-third of the stack was used in the early spring, and the remainder is being held for a possible dry spell in the autumn.

Mangolds and swedes, together with hard turnips sown in February on oat stubble, provide winter roots, which are fed with hay. The only other supplement to the pasture is green oats, fed in the early spring before the pasture begins to move appreciably. A good combination used at Puwera was $1\frac{1}{2}$ bushels of Algerian oats sown with 25 lb. of grass-pea and 4 lb. of crimson clover. The crop was cut for hay after several grazings. Oats are grown each season for chaff to supply horse-feed.

With the use of paspalum and kikuyu-grass for late summer and autumn feed, the area devoted to special crops at Puwera is greatly reduced. Other than a small area of maize and sorghum, together with the silage already referred to, no extra cropping should be needed. The problem for the average North Auckland farmer, especially on the better soils, should be even easier of solution than at Puwera.

KIKUYU-GRASS.

After about three years the kikuyu pasture on Field 2 became sod-bound. The mass of turf was turned-under by the mouldboard plough in the middle of August, received three strokes of the disk harrows early in September, and was sown with the following seed mixture: Italian rye-grass, 12 lb.; red clover, 6 lb.; Lotus major, 1 lb. per acre. Superphosphate, 2 cwt., and blood-and-bone, 1 cwt., per acre, were applied with the seed. It is expected that this procedure will rejuvenate the kikuyu-grass and at the same time provide a temporary grazing resulting from the mixture sown.

The amount of feed provided by the kikuyu-grass during the three seasons from the original sowing was beyond expectation. Kikuyu, when used with red clover or Lotus major, each of which is able to keep pace with kikuyu in the summer, when the growth of the latter is very rapid, makes a good sward. White clover, on the other hand, is smothered unless the pasture is kept short by very heavy stocking, in which case the kikuyu and white-clover combination is an excellent one, as seen at Puwera where a plot was so treated. In fact, it is rather interesting to record that no white clover or manure was sown, but the kikuyu merely kept grazed hard on a small plot of pure danthonia where the kikuyu had been introduced. On the kikuyu plot the white clover has come in voluntarily, and the combination forms a green succulent sward in contrast to the adjoining danthonia, which is dry and uninviting and with no white clover present.

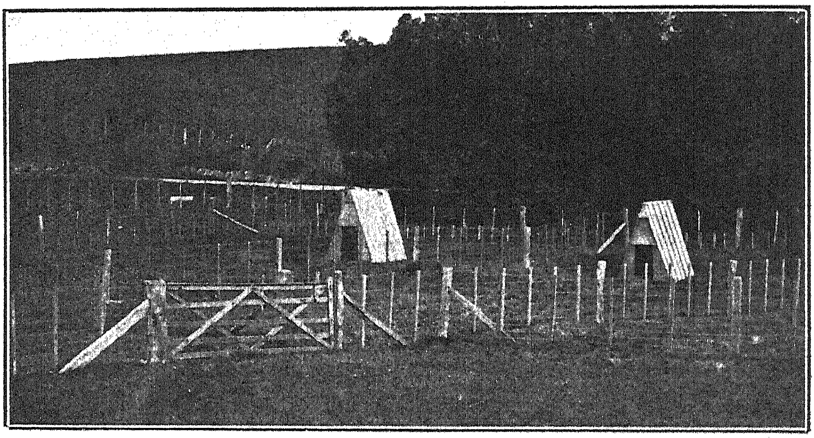
Where a few acres of kikuyu were put down in Field 4 (by broadcasting shoots chopped up with a sharp spade) on a surface only double-disked the grass has taken rather well. Combined with rye-grass and clovers the sward, which was manured with phosphate, is now providing good feed. Probably a better method of preparing the kikuyu would be to put the jointed stems loosely through a chaffcutter, allowing for a

long cut, and then broadcast on a disked surface. A small seeding of rye-grasses and clovers with Lotus major should be added.

As our experience grows with kikuyu-grass it only confirms our early results—that kikuyu has proved a valuable introduction and has added a further useful species of economic value to our grass-lands, especially on areas where the summer is warm and dry and English grasses become unproductive. Like paspalum, it is a very vigorous grower and is highly productive, but, as it has not seeded so far, it can be more easily controlled.

OPEN-AIR PIG-RAISING.

Two pedigree Berkshire sows were purchased at Ruakura State Farm and were put at Puwera in the early spring. They are Dominion Mira and Dominion Palmdale—maiden sows served by Dominion Scholar, one of the best Berkshire sires at Ruakura. One has farrowed and the other is due shortly. The pigs are run on the



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LUCERNE STANDS.

Grazing trials of lucerne have been continued, affording conclusive evidence of the value of this crop under Canterbury conditions. Although certain areas have been grazed on almost every occasion since they were sown in March, 1921, there is very little evidence of deterioration due to grazing, but nevertheless such evidence is directly proportionate to the extent of grazing carried out.

Lucerne is no exception to the general rule governing pasture, in that its productiveness is regulated by seasonal conditions and the class of land on which it is grown. Nevertheless, our present experience would indicate that once established it carries so much more stock than anything else of a permanent nature could do on the medium lands of Canterbury that every endeavour should be made by farmers to establish larger areas for grazing purposes. The following grazing returns afford some indication of the carrying-capacity of the lucerne stands at Ashburton:—

Area of 20 Acres.

9 acres divided into three blocks, grazed as follows: Sept. 11–Dec. 31, 120 hoggets for 112 days; Jan. 1–18, 112 hoggets for 18 days; Feb. 4–12, 127 hoggets for 9 days.

11 acres reserved for hay; cut twice, yielding 29 tons of hay.

Thereafter the total area of 20 acres grazed as follows: Feb. 12–16, 254 sheep for 4 days; Feb. 17–Mar. 14, 208 sheep for 26 days.

The grazing of this area is equivalent to $3\frac{1}{5}$ sheep per acre per annum and 29 tons of hay for winter feeding. Allowing $2\frac{1}{2}$ lb. lucerne chaff per head per day during the winter, this area of 20 acres would carry an equivalent of 128 sheep for six months in summer and 140 sheep during the six winter months (supplemented by winter grazing).

Area of 13 Acres.

Block 1, grazed as follows: Sept. 25–Oct. 8, 168 sheep for 13 days; Oct. 21–Nov. 5, 168 sheep for 15 days; Nov. 17–23, 53 sheep for 6 days; Nov. 24–28, 161 sheep for 5 days; Nov. 29–Dec. 12, 38 sheep for 14 days; Dec. 28–31, 51 sheep for 3 days.

Block 2, grazed as follows: Sept. 30–Oct. 7, 200 sheep for 7 days; Oct. 8–17, 171 sheep for 10 days; thereafter closed and cut once, yielding 8 tons of hay.

Thereafter the total area of 13 acres grazed as follows: Jan. 31–Feb. 17, 190 sheep for 17 days; Mar. 3–20, 150 sheep for 17 days; Mar. 23–28, 120 sheep for 5 days.

The grazing of this area represents a carrying-capacity of 3⅓ sheep per acre per annum, and a yield of 8 tons of hay for winter feed. Allowing 2½ lb. of lucerne chaff per head (supplemented with winter grazing), the carrying capacity of the 13 acres is equivalent to 87 sheep for the six summer months and 40 sheep for the six winter months.

In connection with the feeding of lucerne chaff Mr. McKay reports: "Our experience on the farm has been confined to hand feeding during actual winter months only, when it was found that at least ten ewes per acre could be carried in good health on light land with a supplementary ration of 2½ lb. of lucerne chaff per sheep per day. We cannot at present say for just how long this, or heavier stocking, could be carried on without ill effects to the health of the sheep where lucerne chaff alone is being fed."

PURE LINES OF SEED.

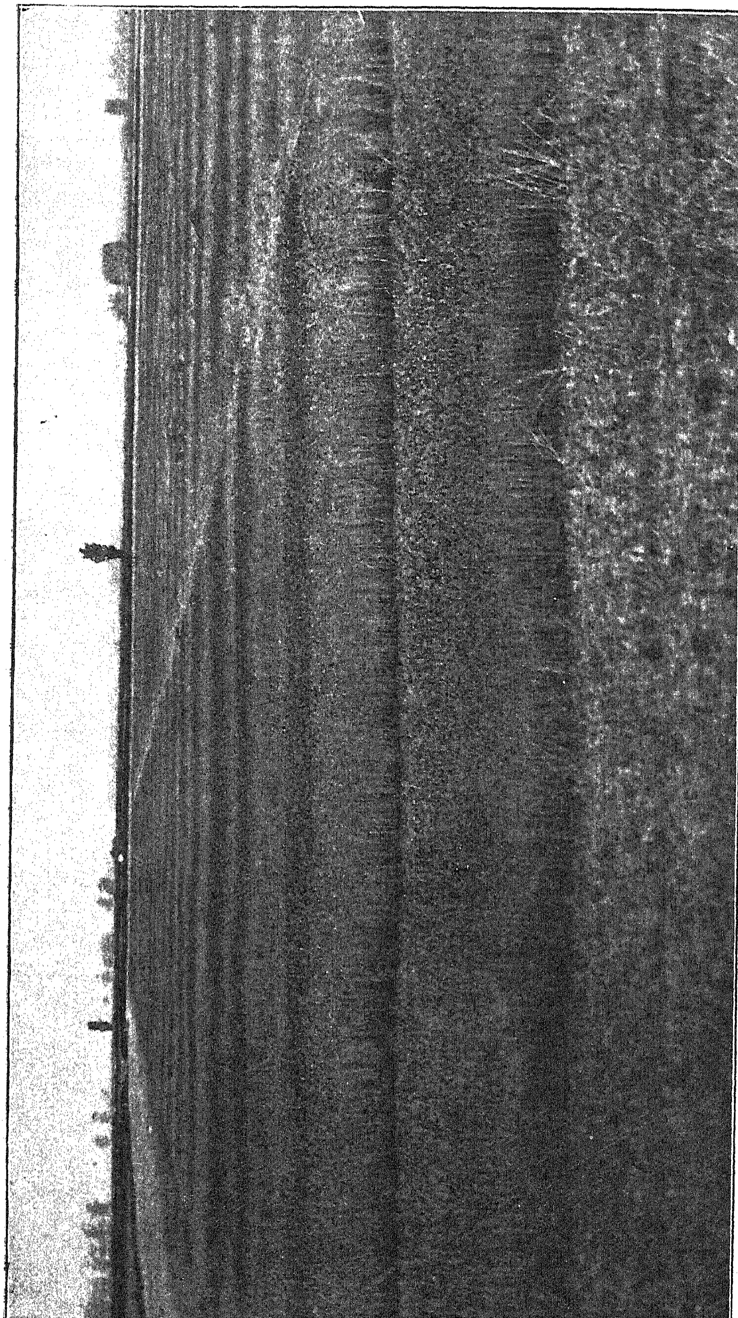
The pure line of Dreadnought wheat selected in the preceding season by Mr. McKay (*Journal*, September, 1925, page 153) has been sown in an increase plot, and the produce from this should form a valuable nucleus in pure-seed production for the farmers of North Otago. Mr. McKay has also raised by careful selection pure lines of the three most important varieties of potatoes in Canterbury—namely, Arran Chief, Bresee's Prolific, and Dakota. It is intended to pay close attention to this aspect of the work in future.

WHEAT VARIETY TRIAL.

A continuation was made of the trial of wheat varieties commenced in the preceding season, each variety again being checked against College Hunter's as the standard. The Hunter's used in the season under review was obtained direct from Lincoln College, having been grown there in the previous season. The product of this will be used as the control variety in the future.

Six replications of each variety were sown with control of College Hunter's immediately alongside each varietal plot. This was obtained by sowing every third plot with College Hunter's. Each strip was divided into three at harvest, giving up to eighteen comparisons with the standard.

The unusually wet season caused extreme caking of the surface of the ground, and this crop, like many autumn- and winter-sown ones in the same period, suffered very badly, as will be seen from the extremely poor yields. So bad was the effect of the wet that portion of one end of the plots had to be eliminated from the yield-determination.



PORTION OF WHEAT VARIETY PLOTS, ASHBURTON EXPERIMENTAL FARM, SEASON 1925–26.

[*Photo by F. E. Ward.*

As in the previous year, all varieties were sown at a rate calculated to give the same number of seeds per acre as 90 lb. of College Hunter's. To arrive at the required quantity of seed for each variety a number of 100-grain samples were weighed and the mean calculated; hence the number of grains per unit weight was arrived at.

Table 1.—Yield of Wheat Varieties, 1926 Harvest.

Area of individual plot = $\frac{1}{68}$ acre. > = greater than (all tables).

Variety.	Number of Paired Plots compared.	Yields per Acre.			Odds.	Date sown in June.*	Date harvested.
		Variety.	College Hunter's.	Difference (+) in favour of College Hunter's or (−) of Variety.			
		Bushels.	Bushels.	Bushels.			
Velvet (Ngapara)	14	13·9	12·7	−1·2	210	26th	8/2/26
Velvet (College) ..	13	14·1	13·5	−0·6	N.S.†	25th	8/2/26
Essex Conqueror..	17	13·9	14·0	+0·1	N.S.	25th	9/2/26
Goldberry ..	17	13·0	13·5	+0·5	N.S.	27th	16/2/26
Solid-straw Tuscan	12	13·6	14·7	+1·1	N.S.	24th	9/2/26
Red Fife ..	16	12·1	13·8	+1·7	180	26th	26/1/26
White-straw Tuscan	15	11·4	13·7	+2·3	950	26th	29/1/26
Yeoman ..	17	11·3	14·3	+3·0	850	26th	16/2/26
Marquis ..	15	12·0	15·2	+3·2	>9999	25th	26/1/26
Zealand.. ..	16	10·0	14·6	+4·6	>9999	27th	29/1/26
Major	16	9·5	14·4	+4·9	>9999	26th	26/1/26
Queen Fan ..	17	8·7	14·6	+5·9	>9999	25th	26/1/26
Queen Fair ..	15	7·7	14·6	+6·9	>9999	25th	26/1/26

* College Hunter's sown 23rd June. † Where the letters "N.S." are inserted in this and other tables the difference is non-significant—that is, the chances are less than 30 to 1 in its favour.

A comparison with the results of the preceding season* will show that several varieties which proved superior in the 1925 harvest yielded very poorly under the adverse conditions met with in that of 1926. While several varieties have held their own with College Hunter's, only Velvet (Ngapara) has proved superior by a small amount.

WHEAT MANURIAL TRIAL.

An experiment on the manuring of wheat was conducted with the following treatments. The paddock had previously been in grass for four or five years.

	Per Acre.
(1.) Control (no manure)	..
(2.) Superphosphate (42/44 per cent.), 104 lb.; and sulphate of ammonia (20 per cent. nitrogen), 82 lb.	186 lb.
(3.) Ammo-Phos (20/20)*	100 lb.
(4.) Super	104 lb.
(5.) Super, 250 lb.; and sulphate of potash (48 per cent. K_2O), 56 lb.	306 lb.
(6.) Super	250 lb.
(7.) Ammo-Phos (13/48)*	100 lb.
(8.) Super, 250 lb.; and sulphate of ammonia, 53 lb. ..	303 lb.
(9.) Super, 250 lb.; sulphate of potash, 56 lb.; and sulphate of ammonia, 53 lb.	359 lb.

* Ammo-Phos is in two grades: that described as 20/20 contains 20 per cent. ammonia (= 16·4 per cent. nitrogen) and 20 per cent. phosphoric anhydride; the 13/48 grade contains 13 per cent. ammonia (= 10·7 per cent. nitrogen) and 48 per cent. phosphoric anhydride.

Fourteen replications of these treatments were sown, each plot being divided into two at harvest-time. Thus, up to twenty-eight paired comparisons were made.

The variety used was Solid-straw Tuscan; seeding, $1\frac{3}{4}$ bushels per acre; date sown, 22nd September, 1925; harvested, 17th February, 1926.

The paddock had been in wheat in the 1924-25 season, and prior to this in grass for four or five years.

Objects of applying Manures as shown.

(1.) Each grade of Ammo-Phos is immediately alongside a mixture of super and sulphate of ammonia containing an equal amount of nitrogen and phosphate. Hence a comparison of each grade of Ammo-Phos was made with standard fertilizers. Plots 3 are compared with Plots 2, and Plots 7 with Plots 8.

(2.) Super alone was sown in quantities equal to those in mixtures 2 and 8 above. Hence Plots 4 are compared with Plots 2, and Plots 6 with Plots 8. This allows a determination of the effect of the sulphate of ammonia as an addition to the phosphate.

(3.) A comparison of the smaller quantity of super with the larger was expected to give some idea of whether an increased amount of super would be profitable in use. Hence Plots 4 are compared with Plots 6.

(4.) An amount of $\frac{1}{2}$ cwt. of sulphate of potash was added to straight super and to a mixture of super and sulphate of ammonia to determine whether its use was profitable. Plots 4 are compared with Plots 5, and Plots 8 with Plots 9.

(5.) All plots are compared with the control.

The results are shown in Table 2.

Comments on Table 2.

(1.) All treatments *other than* straight-out super have given significant increases over control, although the direct comparisons are not shown here. That these increases are due to the nitrogen is evident from the following.

(2.) Neither quantity of super has had any effect on the yield. This result is extraordinary, as the land on which the trial was conducted generally shows a marked response to phosphatic manuring.

(3.) The addition of sulphate of ammonia at the rate of 82 lb. and 53 lb. per acre has caused increases of 5·3 bushels and 4·9 bushels per acre respectively. Sulphate of ammonia costs 22s. per hundredweight, so that 82 lb. and 53 lb. costs 16s. and 10s. 6d. respectively. The effect of nitrogen in increasing the yield *may* be as anomalous as the lack of response from phosphates. The winter was extremely wet, and excessive leaching of nitrates must have resulted.

(4.) Both mixtures of super and sulphate of ammonia give decided increases over the Ammo-Phos with which they are compared.

(5.) Sulphate of potash at $\frac{1}{2}$ cwt. per acre, as an addition in one case to super and in the other to super and sulphate of ammonia, shows no significant benefit.

Table 2.—Results of Wheat Manurial Experiment, 1926 Harvest.

Area of individual plot = $\frac{1}{110}$ acre.

Comparison A *versus* B.	Number of Paired Plots compared.	Yield per Acre.	Difference in Favour of A.	Odds.
		Bushels.	Bushels.	
A. Super, 104 lb. per acre ..	26	46·3	0·2	N.S.
B. Control	..	46·1	..	..
A. Super, 104 lb.	26	46·3	0·2	N.S.
B. Super, 250 lb.	..	46·1	..	..
A. Super, 104 lb., plus sulphate of ammonia, 82 lb.	24	51·6	5·3	>9999
B. Super, 104 lb.	..	46·3	..	..
A. Super, 250 lb., plus sulphate of ammonia, 53 lb.	14	51·3	4·9	>9999
B. Super, 250 lb.	..	46·4	..	..
A. Super, 104 lb., plus sulphate of ammonia, 82 lb.	24	51·6	0·8	33
B. Ammo-Phos (20/20), 100 lb. ..	..	50·8	..	..
A. Super, 250 lb., plus sulphate of ammonia, 53 lb.	14	51·3	1·7	1400
B. Ammo-Phos (13/48), 100 lb. ..	..	49·6	..	..
A. Super, 250 lb., plus sulphate of potash, 56 lb.	26	46·3	0·2	N.S.
B. Super, 250 lb.	..	46·1	..	..
A. Super, 250 lb., plus sulphate of ammonia, 53 lb., plus sulphate of potash, 56 lb.	14	52·0	0·7	N.S.
B. Super, 250 lb., plus sulphate of ammonia, 53 lb.	..	51·3	..	..

OAT MANURIAL TRIAL.

With the idea of comparing the effect of superphosphate with a proprietary grain-manure, two experiments in manuring of oats were conducted on the same paddock as that used for the wheat manurial trial. The experiments are referred to as A and B.

Experiment A.

Variety, Garton's; seeding, 90 lb. per acre; date sown, 24th September, 1925; date harvested, 28th January, 1926. The treatments used and the order in which they were sown are as follows:—

	Cwt. per Acre.		Cwt. per Acre.
(1.) Control (no manure).		(5.) Proprietary grain-manure	2
(2.) Proprietary grain-manure	1	(6.) Super	1
(3.) Superphosphate (42/44) ..	1	(7.) Proprietary grain-manure	1
(4.) Super	2		

NOTE.—Minimum percentages of manurial constituents in proprietary grain-manure were: Tricalcic phosphate, 30·35 per cent.; nitrogen (insoluble in water), 1·25 per cent.; potash (equivalent of sulphate potash), 2·0 per cent.

Eighteen replications of the above series were sown, and the plots divided into two at harvest. Total weights were taken just before

threshing, so that evaluation of increases of total weight or grain weight can be made. The results are shown in Table 3.

Table 3.—Oats Manurial Trial, Harvest 1926.

Area of individual plot = $\frac{1}{137}$ acre.

Comparison A *versus* B.	Number of Paired Plots compared.	Total Produce per Acre.		Odds.	Number of Paired Plots compared.	Grain per Acre.		Odds.
		Yield.	Difference in Favour of A.			Yield.	Difference in Favour of A.	
		Cwt.	Cwt.			Bushels.	Bushels.	
A. Super, 1 cwt. ..	50	43·8	1·8	266	50	35·6	0·8	N.S.
B. Control ..	..	42·0	..	..	..	34·8	..	..
A. Super, 2 cwt. ..	24	45·5	3·6	1350	23	38·3	3·2	> 24000
B. Control ..	..	41·9	..	..	..	35·1	..	..
A. Proprietary grain-manure, 1 cwt.	50	43·7	1·7	> 24000	47	35·4	0·5	N.S.
B. Control ..	..	42·0	..	..	..	34·9	..	..
A. Proprietary grain-manure, 2 cwt.	26	46·2	4·0	1350	24	37·2	3·1	16665
B. Control ..	..	42·2	..	..	..	34·1	..	..
A. Super, 2 cwt. ..	36	45·6	1·7	> 24000	35	38·6	2·0	> 24000
B. Super, 1 cwt. ..	..	43·9	..	..	..	36·6	..	..
A. Proprietary grain-manure, 2 cwt.	36	45·9	2·7	3124	34	37·6	3·1	> 24000
B. Proprietary grain-manure, 1 cwt.	..	43·2	..	..	..	34·5	..	..
A. Super, 1 cwt. ..	72	43·8	0·2	N.S.	69	36·1	0·4	N.S.
B. Proprietary grain-manure, 1 cwt.	..	43·6	..	..	..	35·7	..	..
A. Proprietary grain-manure, 2 cwt.	36	45·9	0·3	N.S.	33	37·8	..	..
B. Super, 2 cwt. ..	..	45·6	..	..	..	37·8	..	..

Comments on Table 3.

All manures have caused small but highly significant increases in total produce over controls. The small increases of 0·8 and 0·5 bushel of grain per acre due to 1 cwt. of super and 1 cwt. proprietary grain-manure respectively are shown as non-significant. In view of the certainty attained in the total-produce increases due to these manures it is probable that the grain-weight increases are also real. The 2 cwt. quantities of both manures show decided increases over the corresponding 1 cwt. quantities.

Allowing £3 10s. per ton as the value of sheaves in stack, or 3s. 6d. per bushel as the value of the oats after deducting threshing and haulage costs, none of the increases of control is profitable. In each case the increase is barely sufficient to pay for the cost of the manure used.

The differences between the yields from corresponding quantities of super and grain-manure are not significant.

Experiment B.

In this experiment the same manures were used, but were compared on a phosphate-content basis. Variety, Garton's; seeding, 90 lb. per acre; date sown, 25th September, 1925; date harvested, 27th January, 1926.

The objects of the experiment were (1) to compare applications of 1 cwt. and 2 cwt. of super with quantities of a proprietary grain-manure containing an equivalent amount of phosphate; (2) to determine whether the small amounts of nitrogen and potash included in the proprietary grain-manure were of any measurable benefit.

Hence the manures were applied as follows: (1) Super, 1 cwt. per acre; (2) proprietary grain-manure, 155 lbs.; (3) super, 2 cwt.; (4) proprietary grain-manure, 310 lbs. The larger quantity of grain-manure did not run at the desired rate, and was not taken into account when the measurement of results was made. Forty-three replications of each treatment were applied, and each harvested plot was $\frac{1}{102}$ acre.

The results were as follows:—

	Total Weight per Acre. Cwt.	Grain Weight per Acre. Bushels.
Super, 1 cwt.	38·4	32·5
Proprietary grain-manure, 155 lb. ..	38·0	32·6
Super, 2 cwt.	38·7	33·2

Super at 1 cwt. has been compared with the proprietary grain-manure at 155 lb., and super 1 cwt. with super 2 cwt. Neither comparison shows any significant difference.

General Conclusions.

The use of manures as shown by Experiment A, although causing an increase in yield, has not been profitable.

The fact that the greater quantities of manure used in Experiment A gave significant increases in yield over the smaller quantities points to the slight difference between the 1 cwt. and 2 cwt. quantities of super in Experiment B being a real one, although it cannot definitely be regarded as such. The soil on which Experiment B was conducted was lighter than that used for Experiment A.

The proprietary grain-manure, which cost £7 10s. per ton, has not in these experiments proved superior to superphosphate costing £7 per ton.

The extremely small responses make measurement of differences difficult. With greater effect from manures, as in a more typical season, the differences between manures may be accentuated. The trial is being repeated in the present season.

Effect of Light Seeding.

As an indication of the effect of too light seeding the following is worth recording: In sowing Experiment A an error in the seed-adjustment of the drill was made, with the result that the first six control plots were seeded at the rate of 62 lb. per acre. Naturally these were eliminated from the comparisons already made. A direct comparison between these plots and those receiving 1 cwt. of super

and the normal seeding of 90 lb. per acre shows a difference of 5·3 cwt. of total produce and 5 bushels of grain in favour of the super plots. Where the controls receiving the same amount of seed as the super are compared with the super, the difference is 1·8 cwt. of total produce and 0·8 bushels of grain in favour of super (see Table 3). Hence it seems reasonable to conclude that a seeding of 60 lb. per acre is far too light.

TURNIP VARIETY TRIAL.

A trial of the following varieties was conducted: (1) Lincolnshire Red; (2) Wiboltt's White (flat, green-head) Norwegian May; (3) Funish Bortfelder Long Yellow Improved; (4) Imperial Green Globe; (5) Yellow Tankard Green-top; (6) Ostersundum Medicum (long, red-head, white flesh); (7) Mailand Early Flat Purple-top.

The commonly grown varieties Nos. 1 and 4 were used as the the standards for comparison, and as they did not differ from one another in yield each of the other varieties is compared with the one to which it was nearer.

Eighteen replications of the above series were sown on the flat, each plot being two rows in width, and the rows 24 in. apart. Seeding was at the rate of 6 oz. per acre, the plants being thinned to uniform distance apart.

Super at 1 cwt. per acre was applied. This was sown, part in the seed-rows and part down coulters 6 in. on each side of the seed-rows.

Sowing was done on 28th December, 1925. The germination was good throughout, except in the case of Variety 2 above (Wiboltt's). This variety was almost a complete failure, yielding only 3 tons per acre. The laboratory germination showed a 60-per-cent. germination in four days against from 81 per cent. to 100 per cent. with the other varieties.

Table 4.—Yield of Turnip Varieties, Season 1926.

Area of individual plot = $\frac{1}{605}$ acre.

Comparison A *versus* B.	Number of Paired Plots compared.	Total Weights per Acre. Yield.	Total Weights per Acre. Difference in Favour of A.	Odds.
		Tons.	Tons.	
A. Var. 4, Imperial Green Globe ..	41	34·3	0·2	N.S.
B. Var. 1, Lincolnshire Red ..	..	34·1	..	..
A. Var. 4, Imperial Green Globe ..	42	34·0	4·2	>24000
B. Var. 3, Funish Bortfelder ..	..	29·8	..	..
A. Var. 4, Imperial Green Globe ..	41	34·1	14·5	>24000
B. Var. 5, Yellow Tankard Green-top	..	19·6	..	..
A. Var. 4, Imperial Green Globe ..	42	34·0	9·2	>24000
B. Var. 6, Ostersundum	..	24·8	..	..
A. Var. 1, Lincolnshire Red ..	39	33·4	13·8	>24000
B. Var. 7, Mailand	..	19·6	..	..

At the time of weighing—17th June, 1926—all varieties were sound, and the growth of tops was greatest on the standard varieties Nos. 1 and 4. Varieties 2 and 7 had lost their tops completely, while the tops on Nos. 3, 4, and 5 were dying off. The tops of No. 6 were almost gone. During June, July, and August the plots were fed off, and Mr. McKay reported that although the Imperial Green Globes were the soundest the sheep showed no preference for any particular variety. The total weights of tops and roots are shown in Table 4.

Comments on Table 4.

Imperial Green Globe and Lincolnshire Red have given equal yields. The only variety which has approached either of these in yielding-capacity is Funish Bortfelder Long Yellow Improved.

In order to get an approximate measure of the proportion of root and top to total yield a smaller number of weighings were made of the roots and tops separately in the case of Varieties 1, 3, 4, 5, and 6. The "roots" expressed as percentage of the total weights are as follows :—

Variety.	Per Cent.	Number of Determinations.
1	85·5	14
3	94·4	14
4	92·9	13
5	94·9	13
6	97·1	14

In "Rations for Live-stock," by Professor T. B. Wood, the feeding-value of tops is given as approximately one-fifth greater than that of the "roots." This value of tops must necessarily depend upon the time at which they are fed off, and it is assumed that the total produce as shown in Table 4 gives a fair measure of the relative values of the varieties. Generally speaking, in Canterbury tops have succumbed to the attacks of aphis and diamond-backed moth before feeding is done in winter.

LIMING AND PHOSPHATE TOP-DRESSING OF LUCERNE.

In last year's report on the farm operations a short account of the result of top-dressing of lucerne is given. The treated plots, which were duplicated, were again weighed in the first crop of 1925–26. No additional treatment had been applied. At the time of cutting the control plots were conspicuous by their lightness in colour and slightly poorer growth as compared with the treated ones. Twelve weighings from each treatment were made on 9th November, 1925. The hay weight proved to be 26·9 per cent. of the green weight. The results were as follows :—

	Yield of Hay, Tons per Acre.	Increase over Control, Tons per Acre.
Control	2·19	..
Super, 2 cwt.	2·56	0·37
Lime, 840 lb.	2·52	0·33
Lime, 420 lb., plus super, 2 cwt.	2·67	0·48

All increases are highly significant, and, in addition to those recorded in last year's report, can leave no doubt as to the benefit that has been derived from all applications, the recorded yields from which are from only one crop in each season.

GREEN MANURIAL TRIAL.

Last year's report briefly described the commencement of a green manurial trial in which plots having rape fed off and bare fallow are included. The whole area was sown in Garton oats at 2 bushels per acre, with 1 cwt. super, in September, 1925. The plots were harvested early in February. Mr. McKay reports that the whole area was worked up with grubber and harrows in the early spring prior to sowing. The wet spring affected tillering, and the crop was light. Differences in growth were sufficiently marked in the early stages to be quite noticeable, the plots having rape and those with oats and vetches ploughed in showing the greatest amount of growth. Some of the plots, particularly those which were bare-fallowed, had a considerable amount of fat-hen weed present.

As mentioned in last year's report, there were three replications of each treatment. Each plot was 21 ft. in width. In sowing the oat crop the two drill-widths falling nearest the middle of each plot were defined by a 14 in. space on each side. These strips were harvested in six lengths, giving eighteen individual plots in each treatment. Owing to the incidence of fat-hen on some of the plots grain weights only are recorded.

Table 5 gives full details of treatments and yields of the oat crop.

Table 5.—Green Manurial Trial.

Area of individual plot = $\frac{1}{58}$ acre.

Treatment.	Seeding per Acre.	Date sown.	Date ploughed in or fed off.	Approximate Weight of Green Material per Acre.	Yield of Oates per Acre in 1926 Harvest.
Section 1: Yields not differing from one another to significant degree, but all significantly superior to those in Section 2.					
				Tons.	Bushels.
Rape (ploughed in)	2½ lb.	24/11/24	31/1/25	7·3	30·3
Oats and vetches ..	1 bushel and 2 bushels	6/9/24	8/12/24	6·3	32·4
Crimson clover ..	8 lb.	6/9/24	9/12/24	Not weighed—mostly fat-hen.	27·7
Rape (fed off)* ..	2½ lb.	24/11/24	20/1/25	..	29·7
Section 2: Yields not differing from one another to significant degree.					
Mustard ..	10 lb.	4/9/24	13/11/24	3·7	18·3
Cape barley ..	2 bushels	4/9/24	13/11/24	3·0	20·5
Bare fallow ..	..	..	..	..	18·4

* Rape lots fed off were sown after blue lupins which failed. As all lots had 1 cwt. of super applied at time of sowing, these plots received a double application.

Comments on Table 5.

Those plots shown in Section 1 have proved quite superior to those in Section 2, and with the exception of the crimson-clover plots have the highest amount of green material. The fed-off rape plots were about equal to the ploughed-in ones. As previously mentioned, the crimson-clover plots had a large amount of fat-hen.

The bare-fallow plots were handicapped by the incidence of fat-hen in the subsequent oat crop, and no doubt the extremely wet winter caused a large amount of leaching and probably greater compaction of the soil where newly-turned-in organic matter was absent.

The effect of green manure is not likely to be sufficiently great to give a sufficient increase in one season to compensate for the cost of growing a crop for the express purpose of ploughing in. Consequently the effect, which is likely to extend over a period of time, must be followed up, otherwise a true measure of its economic value cannot be obtained. It is intended to weigh crops on these plots for a number of seasons.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

TARANAKI AND WANGANUI DISTRICTS COMPETITIONS, 1925–26.

A. J. GLASSON, Fields Instructor, Hawera.

IN the past season these competitions were again carried out in the North and South Taranaki and Wanganui districts on similar lines to those of previous years. Mangold and carrot crops were grown in all three districts; in Taranaki calf clubs were also run. The interest in the competitions continues to increase, and the results obtained are gratifying.

ROOT-GROWING.

The season on the whole was not very satisfactory, some plots being either wholly or partly spoilt by a dry spell at sowing-time unduly retarding germination. This was followed by a wet January that made cultivation difficult at a time when it would have been of most benefit to the crops. Some of the districts also experienced a fairly dry autumn that was not conducive to heavy crops generally; it was noticeable that most of the heavy crops were grown in rather damp situations. The standard of cultivation and general care of the plots showed an improvement on previous years.

The mangold variety grown was Cross and Sons' Giant Orange Globe, which proved to be satisfactory, only a few cases of roots not true to type being found. The carrot variety was Sutton's Matchless White, which was rather inclined to premature seeding, but otherwise satisfactory.

Seed was supplied for 506 plots, as compared with 429 plots for the preceding season; 313 plots, or 60·8 per cent. of the entries, completed, as compared with 66·4 per cent. for the previous year. This falling-off in the number of the plots judged as compared with the seed supplied was partly due to the poor germination of a number of the crops, the reason for which has already been mentioned. This was particularly noticeable in North Taranaki, where only 54 per cent. of the crops for which seeds were supplied were finally judged. Plots destroyed by stock were not so numerous as previously, but

there is still room for improvement in this direction. Some parents also pulled their children's plots before judging-day because they happened to be pulling their own. If those parents who do this sort of thing, and also do not take sufficient care to keep stock from gaining admission to the plots, were to take a little more interest in the work, then the percentage of completions would be a good deal higher. However, it is pleasing to note that supervisors, teachers, and the majority of parents take a very keen interest in the welfare of the clubs.

The average weight per acre of the 184 mangold crops judged was 50 tons 12 cwt., compared with 47 tons 11 cwt. the previous year and 56 tons 14 cwt. for the 1923–24 season. The dry spell during the autumn did not have the same effect on the deeper-rooting carrots, and 149 crops averaged 40 tons 5 cwt. per acre, against 35 tons 12 cwt. for the preceding season. The average yields per acre for the various districts were: Mangolds—North Taranaki, 52 crops, 48 tons 10 cwt.; South Taranaki, 58 crops, 56 tons 14 cwt.; Wanganui, 74 crops, 47 tons 7 cwt. Carrots—North Taranaki, 41 crops, 29 tons 14 cwt.; South Taranaki, 57 crops, 43 tons 17 cwt.; Wanganui, 31 crops, 47 tons 14 cwt.

The heaviest mangold crop—116 tons 17 cwt. per acre—was grown by Gordon Martin, Upokongaro School (near Wanganui); the heaviest crop in 1924–25 was 101 tons 7 cwt., grown by Clarence Morrison, Turakina. The heaviest carrot crop was grown by Ray Wallis, Okaiawa School, who had a record crop for the competitions of 76 tons 13 cwt. per acre; the best crop in the preceding season was 66 tons 13 cwt., grown by R. Calvert, Hillsborough.

The placings for the championships were as follows, the places named referring to schools in each case:—

Mangolds.—North Taranaki: Vall Penwarden, Tataraimaka, 104 tons 11 cwt. per acre, 197½ points, first; G. Penwarden, Tataraimaka, 98 tons, 193 points, second; Teresa Fabish, Tataraimaka, 83 tons 1 cwt., 179 points, third.

South Taranaki: Harry Willis, Matapu, 100 tons 8 cwt., 194½ points, first; Lloyd Walker, Oeo, 95 tons 12 cwt., 185½ points, second; Bertha Widmer, Mokoia, 95 tons 12 cwt., 184½ points, third.

Wanganui: Gordon Martin, Upokongaro, 116 tons 17 cwt., 205¾ points, first; Clarence Morrison, Turakina, 108 tons 6 cwt., 205¼ points, second; Dave McDonald, Alton, 113 tons 3 cwt., 203 points, third.

Carrots.—North Taranaki: Cliff Tyrrell, Rahotu, 67 tons 7 cwt., 154¼ points, first; Jeff Longstaff, Huirangi, 58 tons, 148 points, second; Alex. Hamil, Rahotu, 44 tons 13 cwt., 140½ points, third.

South Taranaki: Ray Wallis, Okaiawa, 76 tons 13 cwt., 162½ points, first; Stanley Coleman, Te Roti, 71 tons, 160 points, second; Una Glynn, Ohangai, 57 tons 6 cwt., 157¼ points, third.

Wanganui: Sybil Lethbridge, Waitotara, 66 tons 7 cwt., 156¼ points, first; John Middleton, Waverley, 63 tons 19 cwt., 154¾ points, second; Dorothy Dunlop, Fordell, 57 tons 4 cwt., and Janet Train, Waitotara, 57 tons 1 cwt., both 150 points, third.

As usual, exhibits from the clubs were staged at the Hawera, New Plymouth, and Wanganui winter shows, and were very favourably

commented upon. In the competitive classes at all three shows there was an increase in the number of entries, and the quality was quite as good as that in the open classes.

CALF-REARING.

North Taranaki.

The entries were slightly in advance of those for the 1924–25 season, and 54 calves were judged. Competition was very keen, and the condition and quality of the calves generally better than in any previous year. Record charts were also well done, some being very fine, and the remainder slightly better than in previous years. The championship placings were as follows :—

Jersey or Ayrshire : A. J. Paterson, Kaimiro, 140 points, first ; Elsie Moffitt, Warea, 139 points, second.

Friesian or Shorthorn : L. Lambert, Bell Block, 137 points, first ; D. Goble, Durham, 133 points, second.

South Taranaki.

Here the entries showed a large increase, and 155 calves were judged, compared with 96 last year. Again the condition and quality of the calves and the record charts showed an improvement on previous years. The 155 calves judged represented the following breeds : Jersey, 131 ; Friesian, 17 ; Shorthorn, 6 ; Ayrshire, 1. All the calves were grade heifers, and the numbers give some idea of the popularity of the Jersey breed in this district. Following were the placings in the championship judging :—

Jersey-Ayrshire : N. Walker, Okaiawa, 142 points, first ; G. Anderson, Toko, 140 points, second ; W. Dakers and C. Rothery, Manaia, and E. Bennett, Normanby, all 138 points, third.

Shorthorn - Friesian : M. Major, Rawhitiroa, 140 points, first ; E. Major, Rawhitiroa, 138 points, second ; M. Jones, Finnerty Road, 136 points, third.

Prizes were also given for dairy type, and these were won as follows : Jersey-Ayrshire class, I. Kirk, Auroa ; Friesian-Shorthorn class, C. Betts, Okaiawa.

Judging was carried out on the lines of 50 points for record and 100 points for the condition of the calf. Points for the cost of food fed to the calf are no longer given, as it is found that these are very unsatisfactory. Information as to the class of food, amount, and cost must still be entered on the record charts, and these show a very wide range — from 2s. 1⅓d. to £3 19s. per calf. Since the rule as to no points for cost of food was introduced in 1924 the average cost of food has shown a fairly marked increase as follows : 1922, 16s. 6d. ; 1923, 16s. 2¼d. ; 1924, 18s. 1½d. ; 1925, 24s. 3d. However, as the condition and quality of the calves generally show an improvement, this may be an advantage rather than a disadvantage, provided that too high a cost is not obtained so as to make the rearing an unprofitable undertaking.

Registered Apiaries.—The total number of apiaries in the Dominion at 31st March last was approximately 7,100, representing nearly 100,000 colonies of bees.

TOP-DRESSING OF KING-COUNTRY HILL LANDS.

A SURVEY OF ITS VARIOUS ASPECTS.

J. E. F. JENKS, N.D.A., Instructor in Agriculture, Te Kuiti.

IT is now beyond question that one of the main causes of the "deterioration" of so much of the North Island hill country is the fact that its natural fertility has been severely depleted by the production and sale of young stock. There are, for instance, many cases in which land has been "held," and even "brought back," without top-dressing, simply by means of substituting mature cattle and sheep for breeding-ewes. It is, of course, open to question whether this expedient could check deterioration indefinitely, but its success provides further proof, if it were needed, that the supply of available phosphates and lime in these soils is one of the limiting factors. For many years to come the production of lamb will be the best source of revenue on these hill lands, and lambs cannot be bred and reared successfully unless the removal of phosphates and lime is counterbalanced by suitable and adequate manuring. There is little doubt that had top-dressing been commenced eight or ten years ago, when the land was still in comparatively good order, there would be very much less deterioration to-day.

Seeing that King-country settlers commenced manuring their hill lands only some four or five years ago, and that it is only during the past two years that the practice has become at all general, present experience, though fairly wide in scope, does not cover any lengthy period of time. For example, the residual effect of manure is still largely a matter of conjecture. However, there is at the present time a large number of experiments in hand, and these should considerably enlarge our knowledge. In addition to various small-scale trials for comparing the different manures and mixtures, there are now in progress experiments on a larger scale designed to gain information on the following points :—

(1.) The comparative response of the different classes of land to fertilizers.

(2.) The approximate length of time required before the fertilizer takes effect.

(3.) The labour costs of applying the fertilizer, &c.

(4.) The return that can reasonably be expected under different conditions.

(5.) The residual effect of fertilizers.

The principal line of action at the present time is to take a comparatively large block of land, and to obtain the desired data by record and observation extending over a period of years.

THE ECONOMIC ASPECT.

Probably the most influential factors here are the quality of the soil and, to a less extent, the age of the pasture and the type of management followed. Generally speaking, the poorer the land and the older the pasture the slower will be the response and the more doubtful the financial returns. It is difficult to find an instance in

which manuring has *not* brought about an improvement both in pasture and stock; but on certain types of land, more especially broken country of low natural fertility, it is doubtful whether as yet this improvement is sufficient to meet the bill for fertilizer, freight, cartage, and labour. A financially embarrassed settler can scarcely be blamed for asking, "Does it pay?"

He can very largely be reassured if he will realize the fact that there are at least six different ways in which expenditure on top-dressing is repaid:—

(1.) Increased cash income, due to the larger number of stock carried and their increased health and productivity.

(2.) Reconversion of store country to breeding country.

(3.) Lower mortality of stock.

(4.) Enhanced value of the pasture itself. Capital expenditure on grassland, fencing, &c., is increased in value; in some cases top-dressing saves this capital from complete obliteration.

(5.) Lower maintenance expenses—for example, cattle for crushing &c., and scrub-cutting.

(6.) Benefit to the holding as a whole by the conversion of part of it into a recuperative and fattening area.

The influence of the quality of the land itself is in many cases very striking. Not only does the better-quality land respond more rapidly to top-dressing, but the naturally greater productivity of the stock on such land increases the profit derived from the operation.

To quote instances: A settler near Te Kuiti has obtained in one particular paddock of easy papa country an increase in carrying-capacity of a ewe per acre after a single application of 2 cwt. of fertilizer per acre. As his lambs are sold fat off their mothers, and his ewes average 9 lb. per fleece, he can estimate his immediate return at £1 10s. per acre, and he still has the residual effect of the fertilizer.

Again, a holding at Matiere includes a steep face divided into three paddocks. This face was originally in tawhero and manuka, and that the pasture has been hard to hold is evidenced by the fact that the occupier has had to do a considerable amount of crushing and burning during the last two years However, the underlying formation is good heavy papa, and last season it carried rather more than a ewe per acre. The first paddock of 40 acres was top-dressed late in July with 2 cwt. of basic super per acre; it has since been carrying 120 ewes. The second paddock of 25 acres had 2 cwt. of superphosphate per acre in August; it is now carrying sixty-five ewes. In both paddocks the sheep are in thriving condition and the feed is gaining on them. The third paddock of 40 acres, left unmanured, is with difficulty carrying fifty ewes. It is interesting to note that the response to the fertilizer was almost immediate, and that the feed on the top-dressed portion of the face is now immensely superior to that on the easy country above and below it. This striking result can be attributed partly to good stock-management, but more to the fundamental fertility of the underlying formation.

At the other end of the scale we have the type of land that is at present incapable of carrying more than a small stocking of dry sheep and cattle. Experience gained to date seems to indicate that the most that can be expected in such cases from two applications of 2 cwt. each is an increase of 100 per cent. — say, from 75 to 150 sheep per 100

acres; under favourable circumstances the land may be reconverted from wether country to ewe country. However, at a sanguine estimate the increase may be put at 10s. per acre over a period approximately equivalent to four years, a total of £2 per acre. As the cost of the dressing varies from 15s. to £1 per acre, it will be seen that the actual cash profit on the transaction is, at present prices, doubtful, though, for the reasons previously given, the benefit to the holding as a whole may be considerable.

In regard to land that is in an intermediate stage of reversion, it can be safely said that, where bracken fern is dominant, manuring combined with suitable subdivision and cattle-crushing is, in the great majority of cases, a better and cheaper method of reclamation than burning and resowing. Provided that the land was originally sown with an adequate grass-mixture and has not been overgrown for too long a period, the ground will be found to have retained enough seed and attenuated plants of grass and clover to form once more a good turf when the covering of fern has been opened up by the cattle and their good work followed up with the application of a suitable fertilizer. Where resowing is carried out, top-dressing and good stock-control are still needed to save the young pasture from domination by the young and reinvigorated fern.

CHANGES IN PASTURE-COMPOSITION DUE TO TOP-DRESSING.

On this subject it is rather dangerous to be dogmatic, because so much depends upon the nature of the land, the existing sward, and the type of management followed. Some land, by reason of its steepness or other natural disability, is unfitted to carry more than a moderate sprinkling of the better species. In such cases top-dressing will invigorate and improve the "hard" grasses and minor legumes that are the natural covering for that class of land, but it is useless to expect the fertilizer to restore the full mixture of English grasses with which the land was originally sown. Again, heavy continuous grazing with sheep will largely nullify the effect of top-dressing by denying the herbage plants a chance to avail themselves fully of the fertilizer. Top-dressing must be intelligently followed up.

Generally speaking, the first symptom of improvement after top-dressing is a steady increase in the minor legumes, such as suckling-clover and the lotus species; these tend to take charge of the bare patches and to replace the smaller weeds. At the same time the grasses will show an increased vigour, more especially if spelling is intelligently carried out. The stock show greater vitality, and can be induced to clean up fern and piripiri (hutiwai) with much less harm to themselves. The herbage plants, Lotus major in particular, are encouraged to push through existing patches of moss and piripiri. Later, and particularly if cattle are the dominant grazing-animals, cocksfoot and Poa pratensis are greatly stimulated and tend to take the ground occupied by the poorer grasses. Later still rye-grass may reappear, and white clover will tend to replace the minor legumes. The herbage will start growth earlier in the spring, will be less affected by dry weather, and will continue growth later in the autumn. Fern, piripiri, hawkweed, and even seedling manuka and gorse will tend to disappear by reason of the increased hoof cultivation and the greater palatability of the herbage.

MANURES AND METHODS.

Choice of manure now presents no serious problems. The great point is to obtain as much quick-acting phosphate as possible per pound spent. On the heavier and moister classes of land, slag is undoubtedly the most suitable, its only drawback is its mechanical texture, which renders even distribution difficult and laborious. Some settlers overcome this difficuly by mixing super and slag in the paddock, and it is possible that the super and Nauru mixture may prove an efficient substitute. On all classes of land super appears to work well, though it is supposed, not unreasonably, that an admixture of lime with it gives feed of better quality. On soils of volcanic origin it is certainly desirable to use a small proporation of lime in order to get the best results from the super. It is, however, extremely doubtful whether large dressings of lime are profitable, at any rate where the cost of cartage and distribution is high. The value of potash is still in doubt, though this season's work may yield more definite results.

The question of quantity of fertilizer per acre, from an economic point of view, is still in doubt, and should be the subject of further trials. At present the limited finances of the settlers tend to make the probable effective minimum of 2 cwt. per acre the standard dressing. Finance permitting, it may well be that a dressing of up to 6 cwt. per acre is justified in some cases, both by its immediate effectiveness and by saving the labour of annual dressings. It is, at any rate, fairly certain that where a second dressing is obviously required it is better to do this than to push out on to fresh areas. It is, too, a sound plan for the man of limited means to concentrate on his cleanest paddocks first. He can then use the revenue he has derived from their increased productivity to extend his manuring further afield.

Another thing worth trying is the top-dressing of the harder portions of paddocks that comprise both easy and difficult land. The latter is not only in itself low in fertility, but always tends to revert to fern by reason of the fact that stock are apt to neglect it. Stock will always follow the manure-bag.

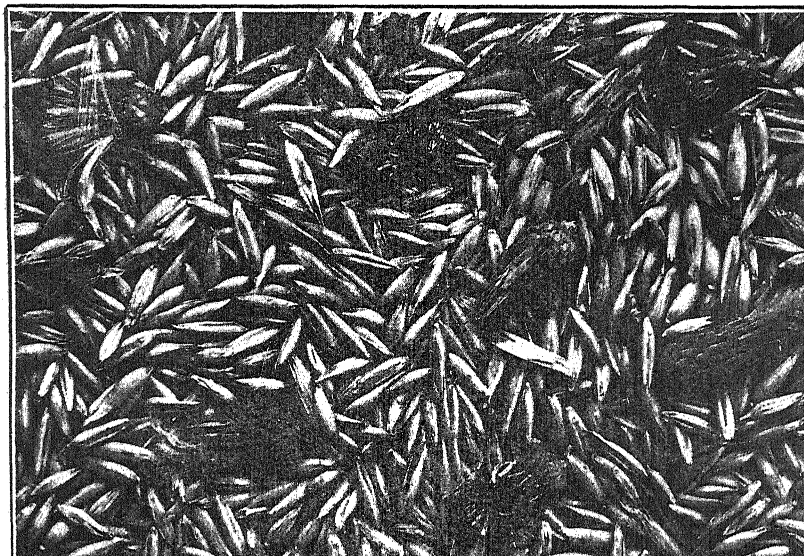
Settlers are rapidly adapting themselves to this new piece of farm routine. A little experience can save much time and labour. One settler who manures several hundred acres annually has constructed at his wool-shed a special platform for the more expeditious loading of packhorses. Generally speaking, the cost of labour for dressing varies from 1s. 6d. to 3s. per acre, and packing or sledging 6d. to 1s. 6d. according to the distance. Fertilizer manufacturers or merchants might well make a regular practice of sending out manure in stout 100 lb. bags suitable for horse-packing.

Underplanting in Native Forests.—The Conservator of Forests for the Rotorua Region states that Lawson's cypress continues to show the best results for this purpose, and generally has made excellent growth. Other species, while making fair to good growth in open spaces, are poor or entirely suppressed where the undergrowth is heavy or the shade dense. Success in underplanting indigenous forests with exotic trees, he adds, depends principally upon the selection of certain tolerant species and periodical clearing of the undergrowth.

CALIFORNIAN-THISTLE HEADS IN FEED OATS.

THERE has been received recently from a farmer in the north of Auckland a sample of feed oats containing numerous thistle-heads, with a request that these should be identified, and that he should be informed as to whether there was any chance of spreading the weed by feeding the oats to horses.

The heads were female ones of Californian thistle (*Cnicus arvensis*), which the accompanying photograph of the sample taken just as it was received clearly shows. Moreover, when one or two heads were pulled to pieces numbers of well-filled seeds were found.



PART OF SAMPLE OF OATS CONTAINING CALIFORNIAN-THISTLE HEADS.

[*Photo by H. Drake.*

The effect on their germination of the passing of naked Californian-thistle seeds through the alimentary canal of horses has not been definitely shown by experiment, but it must be plain, to say the least of it, that there decidedly *is* a chance of spreading the thistle by the feeding to any animals of such oats as those illustrated, and it would be a most unwise thing for a farmer to do.

—*Esmond Atkinson, Biological Laboratory, Wellington.*

Calcium Cyanide for Orchard and Garden Pests.—Last season a considerable amount of experimental work was carried out by the Biological Laboratory with calcium-cyanide dust, and good controls were secured against bronze-beetle, apple-leaf hopper, rose-aphis, and woolly aphis, but not red mite.

TESTING OF PUREBRED DAIRY COWS.

OCTOBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

ANOTHER CHANGE IN JERSEY CLASS-LEADERS.

THE October C.O.R. list, printed below, records the performance of a new leader for the three-year-old Jerseys. Ivondale Golden Lass, bred and tested by Mr. P. J. Petersen, of Brixton, near Waitara, has now gained a certificate for the very fine record of 905·01 lb. butterfat, thus increasing the leadership figures for her class by 107·69 lb. Ivondale Golden Lass was 3 years 312 days old at commencement of test; the previous class-leader, Mr. A. Christie's Loo's Queen, commenced her test at the age of 3 years 332 days and gained a certificate for 797·32 lb. butterfat. Ivondale Golden Lass also has a C.O.R. for 601 lb. butterfat in 273 days as a senior two-year-old.

Ivondale Golden Lass is a half-sister to Mr. Petersen's heifer Ivondale Golden Rainbow, who stands at the head of the senior two-year-old Jerseys, as noted in last month's *Journal*, the sire in each case being Aster's Golden Lad. The dam of Ivondale Golden Lass is Ivondale Heather's Girl, who has a C.O.R. for 433·92 lb. butterfat in 302 days, at a commencing age of 3 years 339 days. Ivondale Golden Lass has now been purchased by Mr. A. E. Watkin, of Takanini.

A NEW MILKING-SHORTHORN CLASS-LEADER.

Last month's list included particulars of performance for Messrs. Ranstead Bros.' Matangi Quality 5th, and opportunity is now taken of announcing that this heifer thereby goes to the head of her class, the senior two-year-olds, her yield of 542·66 lb. butterfat defeating the previous class-leader—Mr. Bowis's Mereside Gem—by 61 lb. Matangi Quality 5th commenced her test at the age of 2 years 204 days, and Mereside Gem at 2 years 350 days. Matangi Quality 5th is a daughter of Matangi Quality 4th, one of the best-known Milking Shorthorns in the Dominion. She promises to be a worthy successor of her outstanding dam, who still holds two class-leaderships for the breed.

CERTIFICATES OF RECORD ISSUED IN OCTOBER, 1926.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

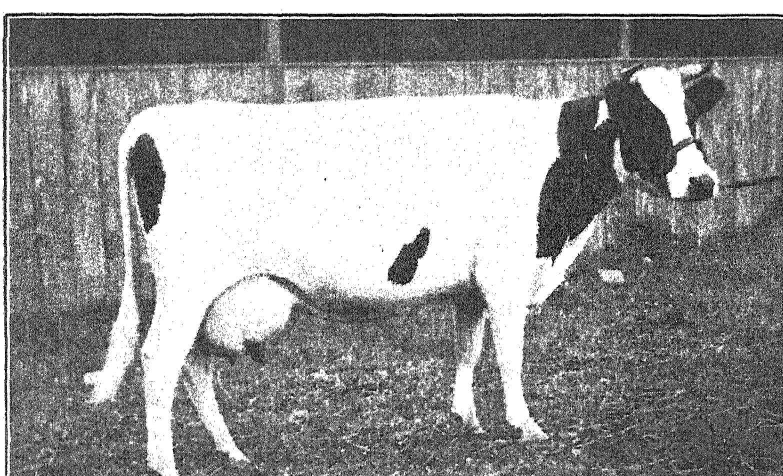
Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS.	Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Jerseydene Sungleam	A. E. Phillips, Maunu ..	2 46	245·1	365	9,662·8	603·67
Alfalfa Mistress ..	A. A. Wagstaff, Waihou ..	1 300	240·5	334	8,922·7	549·03
Orange Dale Violet ..	W. J. Hall and Son, Matatoki	1 355	240·5	365	10,548·6	538·61
Goodwood Clarionet ..	B. N. and W. A. Sandilands, Feilding	1 287	240·5	350	8,508·8	526·87
Jersey Lea Betty Ann	S. Bowker, Ihakara ..	2 35	244·0	365	9,348·9	518·66
Ku Ku Leaflet ..	W. Devine, Palmerston N.	1 326	240·5	365	9,818·2	493·86
Middlewood Lucy ..	B. N. and W. A. Sandilands, Feilding	1 294	240·5	348	7,765·0	489·50
Meadowvale Lady Wayward	E. O'Sullivan and Sons, Tariki	1 350	240·5	365	7,336·4	476·19
Jersey Brae Golden Fox	T. Church, Te Rapa ..	1 358	240·5	364	7,262·0	475·45
Lincoln Laura ..	Dyer and McGuinness, Carterton	2 10	241·5	365	8,507·3	468·30
Miro Meadows Consort	A. A. Ward, Tariki ..	1 343	240·5	365	7,541·6	466·71
Creekton Wee Koura	C. Brock, Eltham ..	2 59	246·4	358	9,306·8	461·02
Jersey Brae Gypsy ..	T. Church, Te Rapa ..	2 25	243·0	363	7,158·9	448·59
Ngahiwi Rosemary ..	W. J. Freeth, Waitara ..	1 310	240·5	365	7,827·6	446·27

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Fantasia	Estate of A. S. Lindsay, Whatawhata	5 242	350·0	365	8,876·8	535·16
Crofton's Queen ..	A. J. Luxton, Omata ..	6 23	350·0	341	8,654·4	531·31
Crimson Rambler ..	J. Mitchell, Woodville ..	7 352	350·0	365	11,802·5	530·35
Sea View's Lady Enid	C. P. Crowley, Kaponga ..	5 323	350·0	365	9,757·6	521·92
Orange Dale's Concord	W. J. Hall and Son, Matatoki	6 1	350·0	334	8,984·9	509·57
Miro Meadows Dot ..	A. A. Ward, Tariki ..	8 322	350·0	365	9,460·7	489·67
Magnet's Leila ..	J. Hale, New Plymouth ..	7 17	350·0	365	8,998·3	484·04
Meadowvale Sweet Dairylike	E. O'Sullivan and Son, Tariki	5 340	350·0	295	9,388·4	480·41
Reid Park's Miss Lizzie	E. J. Adams, Puni ..	5 353	350·0	350	8,666·2	472·50
Oak Farm Rosemary	G. B. Knowles, Tariki ..	5 6	350·0	308	8,661·7	468·14
Ardenlea's Hope ..	G. B. Knowles, Tariki ..	6 41	350·0	365	10,188·2	463·13
Jersey Lea Sweet Maid	S. Bowker, Ihakara ..	6 344	350·0	357	8,086·2	453·85
Snow View Pearl ..	H. Salway, Bell Block ..	5 298	350·0	348	7,411·0	453·74
Charm's Gilt ..	G. Buchanan, Paeroa ..	7 145	350·0	307	8,010·4	408·88
Nessie	J. Blake, Puni	5 272	350·0	342	9,179·8	403·71
	FRIESIANS.					
Junior Two-year-old.						
Melrose Sylvia Griselda Keyes* ..	T. Sherriff, Clandeboye ..	2 31	243·6	365	14,416·7	555·20
Lakeside Netherland Patch 2nd	G. H. Hassall, Clarkville ..	2 160	256·5	343	13,649·2	475·41
Oaklea May Echo Audry†	C. Cates and Son, Kumeu ..	2 168	257·3	365	12,676·8	413·02
Dom. Queen Colantha Jessie	Central Development Farm, Weraroa	1 331	240·5	365	10,483·1	369·12
Senior Two-year-old.						
Totara Park Pietje Alva*	Piri Land Company, Auckland	2 345	275·0	365	17,081·1	599·80
Cluny Queen Coralie	Piri Land Company, Auckland	2 333	273·8	365	16,673·2	565·74
Hanley Butterfly ..	G. H. Hassall, Clarkville ..	2 258	266·3	365	14,418·6	466·26
Senior Three-year-old.						
Bainfield Sylvia Topsy 4th	Mickell Bros., Te Horo ..	3 350	312·0	364	17,540·1	804·73
Dominion Olga of Rock	Central Development Farm, Weraroa	3 271	304·1	365	15,306·5	629·43
Junior Four-year-old.						
Rosevale Sylvia Model Keyes	T. Sherriff, Clandeboye ..	4 166	330·1	365	22,599·4	754·73
Waihi Pietertje de Kol Girl*	J. E. O'Shea, Ohangai ..	4 22	315·7	350	17,461·2	608·47
Springbank Tensen* ..	Wood Bros., Tikorangi ..	4 11	314·6	365	16,802·3	556·65
Hillside Duchess ..	Mickell Bros., Te Horo ..	4 84	321·9	278	13,611·5	537·84
Mature.						
Princess Korndyke ..	W. J. Eames, Hunterville ..	5 319	350·0	365	15,029·2	515·57
Woodlands Cletus* ..	Wood Bros., Tikorangi ..	5 28	350·0	365	14,192·3	493·12

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
	MILKING SHORTHORNS.						
Two-year-old.		Yrs.	dys.	lb.		lb.	lb.
Ridgway Molly* ..	E. Ridgley, Waiuku ..	2	10	241·5	365	11,768·7	515·02
	AYRSHIRES.						
Mature.							
Floss of Braeside ..	Robertson and Blackley, New Plymouth	5	275	350·0	365	14,907·4	678·58
Lady Locket 2nd of Edendale	W. Hall, Lepperton ..	9	286	350·0	365	11,726·5	466·00
	RED POLLS.						
Mature.							
Sylph	Central Development Farm, Weraroa	11	30	350·0	348	9,438·2	409·13
	Second-class Certificates.						
	Jerseys.						
Junior Two-year-old.							
Elcho Fern.. ..	C. J. Masters, Hunterville ..	1	343	240·5	365	7,768·6	418·35
Senior Two-year-old.							
Wichenford Daisy ..	F. I. Washbourn, Timaru..	2	159	256·4	365	5,976·7	302·95
	Friesians.						
Junior Two-year-old.							
Bainfield Sylvia Mimosa 2nd	R. K. Macdonald, Edendale	2	123	252·8	365	12,365·3	400·38



BAINFIELD TOPSY 10TH (O. A. CADWALLADER, GREYTOWN).

C.O.R., 1925, in Friesian junior four-year-old class: 22,456 lb. milk, 863·89 lb. butterfat.

SEASONAL NOTES.

THE FARM.

HAYMAKING.

During the coming month and in January haymaking will be in full swing. Quality in hay is of first importance, and mowing should commence at the right time—that is, when the majority of the plants are in flower. At this period all parts of the plant are more digestible and nutritious than when harvesting is long deferred. The same remarks refer to special hay crops. The next important matter is to save the crop in good condition, and where the grass is dense and heavy it is doubtful whether it can be properly saved without having first been cocked. This method also ensures quality, colour, &c.; there can be no doubt that heavy crops stacked immediately from the swath are very liable to overheat and spoil.

High ground in a convenient position should be chosen for the stack, and plenty of material provided for the stack-bottom. It is well to underestimate the size of the stack slightly rather than over-estimate it, for too often faulty roofs result from a shortage of material. During the building distribute 10 lb. or more of clean, coarse salt per ton of hay. This addition greatly assists palatability, more especially where the material is inferior. Aim to build high, so that the roof area will be small and pressure good.

The aftermath of the hayfield is very valuable, for as a rule it has a high clover content, and, if possible to save, it proves most useful when the grazing pastures begin to fail.

ENSILAGE.

Fields that were shut up early will be ready for ensilage about the end of November. It is important that they be cut as soon as ready, as better ensilage is made, and when the grass is removed early there is usually a good growth of clovers and fine grasses before the warm, dry weather sets in. This is very important if a good grazing aftermath is to be secured. Frequently one sees aftermaths left until they develop into strong, rough growth. This is a great mistake; aftermaths should be carefully grazed as recommended for ordinary pastures, so as to keep the growth fresh and succulent. It is quite good policy to give the hay or ensilage field from 1 cwt. to 2 cwt. of super per acre immediately after the crop has been removed.

Of the various methods of making ensilage perhaps the cheapest and most convenient is the hillside silo, but in many cases a suitable site is not obtainable and the stack method must be resorted to. For this the minimum quantity of material made should be not less than 40 tons, which would require a base of 14 ft. by 14 ft. Sufficient material should be cut and carted to build 6 ft. or 8 ft. in height the first day, and this should then be allowed to stand until a temperature of at least 130° F. is reached, but at no time more than 150° should be attained. The building-up of more material is then continued from

time to time, as heat is generated in each successive layer. For the regulation of heat a thermometer is required, but experienced ensilage-makers are often able to dispense with it. It is always advisable to have a sheet to fasten on to the windward side of the stack, since any wind blows the heat to one end unless such protection is afforded. The dispersion of heat in the stack through this cause is often responsible for badly made ensilage and uneven settling. The sides should be kept as tight as possible and perpendicular during building, and the heart level with or slightly below the outer edge. When the last layer has reached the required temperature the top should be weighted down with soil about 18 in. thick, thus preventing a further rise in temperature. The addition of salt improves the quality of the ensilage, and it is a convenient way of feeding salt to stock.

With lucerne the flowering stage is not a good indication as to the time for cutting. This may be judged better by an examination of the crown; when the new shoots are about 1 in. in length the crop is ready. Lucerne cut for hay should not be allowed to dry too rapidly, and should be handled as little as possible. It may be stacked a little on the green side, but on no account must it be moist with dew or rain.

THE GROWING ROOT CROPS.

Root crops to be thinned, such as mangolds and carrots, and even turnips where they have been sown in wide drills, should have attention as soon as ever the plants are advanced enough to stand the operation, so that they may become well established before the dry weather sets in. Turnips should be thinned to 10 in. or 12 in. apart, mangolds about 1 ft., and carrots 6 in. apart in the drills. At one time it was considered correct to thin mangolds to 18 in. apart, but experience shows that 12 in. generally gives the best results. Medium-sized sound roots should be aimed at rather than big coarse roots of low feeding-value. The land between the drills should be kept well cultivated with the horse or hand hoe to keep down weeds and develop crop-growth. A few hours' work at this time will save days later on.

In most proprietary mangold-manures a little nitrogenous fertilizer has been added, and this is usually sufficient, but should the mangold-plants look pale and appear to be standing still after thinning a top-dressing of ½ cwt. of nitrate of soda per acre will frequently give them a fresh start. If, on the other hand, the plants are growing well and have a good colour they are better without the nitrate. Nitrate of soda should be applied on a damp day. If the manuring has not been too liberal both carrots and mangolds will greatly benefit from 1 cwt. per acre of super broadcasted after thinning.

SOWING OF SWEDES.

In districts where swedes are still a staple crop the latter part of December is the best time to sow, unless earlier sowings have been proved by experience to be satisfactory. The later the crop is sown the less likely it is to be affected by dry-rot; on the other hand, if left too late there is the danger of dry weather and a poor strike. Superlative, Masterpiece, Vilmorin's White Purple-top, Magnum Bonum,

Grandmaster, and Up-to-Date are among the best varieties. They are all liable to attacks of dry-rot (particularly Superlative), but Grandmaster and Up-to-Date are the most resistant. A fine, firm, moist seed-bed is essential, in order that the crop may make a good start and so stand a good chance against the "fly." From 10 oz. to 14 oz. of seed should be sown through every second coulter of the drill; the better the land and seed-bed the less seed will be required. New seed of reliable origin should always be used; old seed is very apt to give disappointing results. Artificial manures should be used with the seed at the rate of 3 cwt. per acre. Most of the proprietary manures give good results, but where the farmer wishes to mix his own equal parts of superphosphate (44–46 per cent.) and basic slag or Ephos phosphate will be found suitable. If slag and super are mixed the material should be used immediately, else it will set into a hard mass. On old land which has been under cultivation for a long period of years ½ cwt. per acre of sulphate of potash added to the aforementioned mixture should be advantageous. Care must be taken that a run-off pasture is available adjacent to the swede-paddock when the crop is fed off. Failing this a supply of hay will be a great asset.

POTATO CROPS.

Potato crops should receive attention by horse-hoeing and moulding up as growth progresses. Spraying should be done during early growth, and repeat dressings given as required. A suitable spraying-mixture is Burgundy mixture, which is made as follows: Dissolve 4 lb. of sulphate of copper in a 40-gallon barrel; then add water to make up to 35 gallons. In another vessel dissolve 5 lb. of washing-soda in 5 gallons of water. When the soda is completely dissolved add two of copper sulphate to one of washing-soda, stirring vigorously all the time. The mixture should be bright blue in colour, and used within ten hours of mixing. —*Fields Division.*

THE ORCHARD.

CULTIVATION.

CULTIVATION should continue to receive special attention, so as to prevent excessive evaporation of soil-moisture. This important work should be repeated frequently to prevent a crust forming on the surface of the soil.

GRAFTS AND DISBUDDING.

Growers are advised to make an inspection of trees grafted in the spring, and stop the growth which develops on the stock below the grafts. When scions commence to swell, the ties should be cut through with a sharp knife on the side of the stock opposite to that on which scions were placed. Do not remove ties or wax.

Remove from the roots and trunks all suckers and superfluous shoots, so that the energy of the tree may be directed towards the development of leaders, laterals, and fruits. Surplus and misplaced growth in the heads of the trees which would be removed at the winter pruning should now be carefully cut out or pinched back, according to which practice will give the desired result.

THINNING.

Practically all danger from frost is now over, and where thinning is necessary and has not been completed stone-fruit growers should proceed without delay to thin out sufficiently to give the remaining fruits ample opportunity for proper development. Pip-fruit growers too often neglect this important operation. The excuse freely given is that no time was available for the work, and that it costs too much. Those growers who have regularly thinned their crops have proved beyond any doubt that thinning pays, and that it helps the tree in many ways. (See last month's notes.)

Thinning is very much a matter of judgment of the individual orchardist. In thinning apples and pears he must consider the variety, habit of bearing, vigour of the tree, distribution of the crop, cultivation, and season, and thin accordingly. The diseased, small, and misshapen fruits should be removed first, and the remaining fruits on normal bearing trees thinned out to from one to two fruits to a spur. On heavy alternate-year bearing varieties it is good practice to leave fruit only on each alternate spur, in order to encourage annual bearing. In the drier districts less fruit may require to be left on the trees in order to develop the crop of fruit to perfection. Scarlet Nonpareil, Cleopatra, Sturmer, Cox's Orange, Yates, and Dougherty require special attention in order to produce good-sized, well-conditioned fruits and to maintain satisfactory tree development and growth.

The setting fruit should be removed from the leaders for a distance of from 15 in. to 18 in. from the tops of the leaders. Jonathan and Rome Beauty are varieties which require special attention in this respect. Stunted and young trees should be heavily thinned.

PICKING.

In preparation for the handling of the new season's crop clean up in and around the packing-shed. The cases and trays should be made up early so as to allow the timber to dry out properly before being used. Repair picking-boxes and ladders, and when necessary replace with new ones.

Before next month's notes appear growers of cherries and early-ripening varieties of peaches and apricots will have commenced to harvest their crops. Pickers, graders, and packers should use every care in the handling of the fruits. The proper degree of maturity at which the fruit should be gathered will vary considerably according to the kind and variety of fruit and the conditions of growth. Fruits should be picked when they have developed their desirable qualities to the fullest extent, or are mature and sufficiently ripe for the particular market to which they are to be sent. The distance fruits have to be sent is an important factor in determining the degree of ripeness at which they are to be picked. The following suggestions are worthy of consideration by growers :—

(1.) The fruit should not be gathered when wet, as moulds and rots quickly develop and damage the fruits. (2.) Where possible, pick fruits during the coolest part of the day. (3.) Do not break off fruit buds, as they are required for next season's fruit crop. (4.) Do

not fill orchard boxes so full as to cause the fruit to be crushed or damaged. (5.) Do not allow fruit to stand out in the hot sun. (6.) Pick at the proper time; fruit picked too early is of poor quality and not suitable for use; fruit picked too late usually arrives on the market in an overripe or rotten condition. (7.) Handle the fruit carefully; lay it in the picking-bucket; do not drop it, as damaged fruit deteriorates quickly. (8.) Have ample and suitable picking equipment. (9.) From three to four pickings at intervals should be made. (10.) Whenever possible, pack directly from the picking-bucket.

Cherries require to be fairly ripe before they are picked, and should be carefully harvested so as to secure part or all of the stem. All blemished, stemless, misshapen, or green fruit should be thrown out by the pickers. Do not touch the fruit any more than can be helped. Apricots, peaches, nectarines, and plums require to be gathered when hard ripe, and should be matured enough so that they will continue ripening and have a good flavour. Apricots should show a tinge of yellow over most of the fruit. Peaches and nectarines should have lost the deep-green cast; white-fleshed varieties should show a light green or silvery-white colour, and yellow-fleshed varieties a golden-yellow tinge on the sunny side. Plums should be picked with stems intact, and care taken not to rub off the bloom.

GRADING AND PACKING.

Proper grading and packing are very important, as a good neat pack helps the sale of the fruit. All blemished and misshapen fruit should be discarded. Every endeavour should be made to grade the fruit to sizes. There should be little variation, because the use of different-sized fruits makes it impossible for the packer to pack the tray or case to the best advantage. It pays to grade all fruits, and to market the fruit in clean, new packages on which the required information has been neatly and clearly stencilled.

SPRAYING.

Spraying for pests and diseases should be along the lines set out in the calendar published in the September *Journal* notes. The most troublesome requiring attention at this period are codlin-moth, leaf-roller caterpillar, pear-slug, red mite, apple-leaf hopper, aphis, black-spot, powdery mildew, and brown-rot. Growers should use every endeavour to control these pests and diseases, and not try to economize by omitting a spray. If in doubt as to whether another application should be made, it is best to be on the safe side and spray again.

It is necessary in order to obtain the best results to supplement spraying by destroying all fallen and infested fruits, and cutting out of badly infected and dead twigs and branches. Growers who have any difficulties in respect to this or other matters pertaining to the orchard are advised to communicate with the Orchard Instructor for the district in which they are situated.

—*W. K. Dallas, Orchard Instructor, Dunedin.*

Citrus-culture.

Cultivation: At this period of the year it pays to give strict attention to cultivation. The land should be worked sufficiently to reduce the surface to a fine tilth, and often enough to keep the surface friable. With the period of minimum rainfall to hand all moisture should be conserved by preventing evaporation and by the suppression of weeds. After light rains, which are to be expected, the surface should be reworked in order to break the crust, otherwise intense evaporation takes place not only of the moisture of recent falls, but also reserve moisture drawn from lower levels.

Sprays: Bordeaux, 4-4-40, should be applied periodically to cover the fruit immediately after petal-fall and to protect the growing fruits. A summer insecticide of oil, 1-60, or Black Leaf 40, 1-800, is required in order to make a thorough job of insect-control and supplement the autumn or spring spraying. Black Leaf 40 may be added to the bordeaux for application.

Pruning: As active growth is resumed there is a tendency for long growths to be made. It is not uncommon to find a rapid growth from 2 ft. to 3 ft. extension without any side growth. Division at the tip takes place, and thus are formed the long objectionable growths. If, however, these rapid-growing shoots are tipped at, say, 1 ft. long, side shoots of a good fruiting-quality are produced and the tree kept within reasonable bounds. As undesirably placed shoots are produced they should be cut away when quite young, this allowing better maturity to those allowed to remain.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

MANAGEMENT OF THE YOUNG STOCK.

At this period of the year there are several matters which the poultry-keeper cannot afford to neglect if the greatest profit is to be made from the plant. No effort should be spared to keep the quarters in a thorough sanitary state to guard against the birds being attacked by insect pests. It is well to remember that these parasites multiply at an alarming rate at this season of the year. Do not be lured into a false sense of security by having new houses. Although the quarters may be comparatively new, it is of the greatest importance that all causes favourable to insect-life be frequently removed. This implies strict attention to cleanliness, the provision of good dusting-places, combined with periodical sprayings of disinfectant.

Do not be tempted to overcrowd the growing birds. This weak policy is bad enough where adult stock is concerned, but it is especially a weak policy in the case of the growing bird. It should not be thought that because the birds have passed the brooder stage special care and management are not as essential as during the brooder stage. If the birds are to grow into vigorous and profitable stock—and they will be profitable only if they are vigorous—this can only come from careful treatment through all stages of their development, not only in the matter of diet, but by comfortable housing without coddling. Confined quarters are not desirable for growing birds. Wherever possible, give

the pullets a free range. In this way they will find for themselves much natural food, and at the same time secure natural exercise—that great essential for vigorous growth. What applies in the case of the pullets applies in equal force to the cockerels intended for future breeding purposes.

Some poultry-keepers provide nothing but small coops for the birds to sleep in after being drafted from the brooder. This is a mistake. If the young stock are to do their best they should be provided with a roomy, partly open-fronted building in which they can remain on cold and wet days, and yet have ample exercise by scratching in litter for their food. No care or attention is too good for the growing pullets, from which so much is expected in heavy production later. Do not on any account keep a weak bird on the plant. All hens of the drone type, and surplus cockerels that have attained a marketable age (about five months old), should be weeded out without delay. Always remember that the food bill is the most serious factor of the business at the present time.

Separate the males from the females before the cockerels commence to crow. This will be to the advantage of both sexes. Do not practise the foolish policy of using inferior foodstuffs because they are cheap. The best, even if it costs more, is always the cheapest in the long-run.

CHRISTMAS DUCKLINGS.

Ducklings now hatched and being reared for the Christmas market must be fed and managed to the best advantage if the maximum price is to be secured for them. A good fattening diet consists of equal parts of maize-meal, pollard, and bran, well moistened with skim-milk, and where the latter is available it should be given to the birds to drink. Feed at least three times a day as much as the birds will eat without waste. In addition, finely chaffed succulent green material should be supplied daily. Where ducks are undergoing the fattening process they should not be given water to swim in ; they will do much better without it.

GREEN FOOD.

On all plants no time should be lost in regard to providing for an abundance of green food for future use. Where there is a stale run, this should be turned over, well limed, and planted with a suitable green material. Do not think that because there is grass in the run this will provide the necessary green food for the growing stock, or indeed any class of poultry. As a general rule any grass that may be in the run, excepting during the spring, is rank and contains too much fibrous material to be of any real value as a green food. Besides, grass in a rank condition is never palatable to fowls. Among other things that may be grown are any of the cabbage varieties or silver-beet, and mangolds, also oats for chaffing in their green succulent state. Of course, as a permanent crop lucerne takes pride of place.

DIET FOR THE GROWING PULLETS.

A correspondent asks if it is advisable to have meat-meal in hoppers at all times for his pullets to pick at after they have attained an age of two months. Personally, I do not recommend this. The food supplied at this age should contain the elements needed to build up

frame and bone, rather than to develop the egg organs—or, in other words, prematurity—a condition which the overfeeding of meat is sure to bring about. The aim should be to bring the pullet naturally to maturity, and this can only be done by plain feeding of sound grain material, of which good plump oats should form a great part of the ration. This, together with an abundance of succulent green material, plenty of grit, and clean water, is all that they require.

It is far too common to see pullets commencing to lay at about four and a half to five months old, due to being supplied with too much animal food. This is a mistake, as such birds seldom grow to a desired size, nor do they produce a decent-sized marketable egg or one fit for hatching purposes. It is not generally known that when a pullet commences to lay she ceases to grow. Obviously, if a bird commences to lay at an early age it will remain a diminutive specimen of its breed. It is sound practice to give chicks a good supply of animal food—say, up to six weeks old—but between this period and until the pullets are well developed to the point of laying, forcing-food should be sparingly provided. Indeed, if it is observed that the pullets show the slightest signs of coming too eaıly to maturity all forcing-food, such as meat or its substitutes, or even milk, should be left out of the ration.

A great weakness on some plants is to feed both the growing and the adult stock on the one class of food. I have seen cases where the morning mash contained a high proportion of forcing-material such as meat or blood meal, this being supplied to all the flock irrespective of age. Such food is specially demanded in the case of the heavy-laying bird, especially when it is intended to cull her out at the end of her productive period. With the growing bird, however, such a forcing diet is quite unnecessary, having the effect of forcing the bird to lay before it has attained a desired age and proper development.

The fact that the modern egg-producing type of pullet is put to a severe strain almost before it has attained maturity obviously goes to show that it should develop naturally and grow to a desired size, in order that it may have the power to resist disease and last out a long laying season. It is not when a bird commences to lay, but the number of good saleable eggs she will produce in two seasons, while at the same time being a desirable breeding-bird, that is the factor determining her value. The age of six months is soon enough for a pullet to start her period of production, and this may be extended in the case of the heavy breeds. The day has long passed for the view that early maturity is an index to profitable production and breeding-power.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

FORMING NUCLEI.

WITH the approach of the main honey-flow and the prospect of more settled weather the beekeeper can turn his attention to the question of forming nuclei, either with an eye to artificial increase or for queen-raising purposes. Whatever the object for which they are produced, the simplest method of forming nuclei is as follows: From the strongest

colonies in the apiary take combs of sealed brood with adhering bees. Place two of these combs in each nucleus hive, together with one comb of honey and an empty comb. It is as well, if the size of the hive will permit, to add a feeder. Close the entrance of the nucleus hive by tacking over it a piece of perforated zinc or wire cloth, and place the newly formed colony in a cool place for twenty-four hours. At the end of this time the hive may be placed on its permanent stand and the entrance opened. Some of the field-bees will return to the parent hives, but in the meantime much of the sealed brood will have hatched, and thus the absconders will hardly be missed. The small colony can at any time be given a ripe queen-cell, and under favourable weather conditions will soon possess a laying queen.

Nuclei can be built from one or two strong colonies, each of which should produce four or five small colonies; or several hives in the apiary may each be robbed of a frame of brood, thus providing increase while leaving the full colonies practically undiminished. When the young queen commences laying in a nucleus hive she should be left in possession until she has filled two frames with eggs, when she may be removed and given to a colony which requires requeening. The nucleus should at the same time be supplied with a ripe queen-cell, and the process repeated as long as young queens are required.

REQUEENING.

The most important bee within the hive is the queen, and it is useless to expect a colony to be productive unless she is a good one. It is therefore highly essential that all colonies should be headed with prolific queens of a good strain if vigorous workers are to be raised. Queen-rearing is an important adjunct in apiary-management, and unless provision is made to requeen systematically the beekeeper will find dwindling colonies and diminished crops. Where practicable, it is advisable to requeen the colonies every year. Exception, however, must be made in the case of hives containing breeding-queens, and others retained on account of desirable drones. Where the operations of the beekeeper are such as to prevent annual requeening, provision should be made to replace half the queens in the apiary each year. If this plan is followed no colony will have queens more than two years old. With the aid of a few nuclei young queens can easily be hatched and mated, but in many cases—especially where a swarm has emerged from a hive—virgin queens can be secured, and form an easy solution of the requeening problem.

No better plan can be followed by the beginner than to utilize queen-cells produced naturally—that is, under the swarming impulse. In New Zealand it has been proved that the best months for raising queens are from November to January. During this period everything is favourable to the operation, as the hives are at their highest state of prosperity. Under normal conditions the workers and drones are at their best, this being the swarming-period. There is practically no risk of robbing; the young queens are readily accepted, and will tend to reduce swarming. Moreover, a queen introduced during the months of prosperity will produce numbers of young bees for the winter, and still be fairly young in the following spring. In the case of after-swarms, these may be sifted through an excluder placed between two empty supers, when the queen or queens can be removed. The bees will then return to the parent hive.

These young queens can be utilized for starting nuclei. It always seems a pity to destroy the young vigorous queens bred under the swarming influence, and wherever there is an opportunity they should be saved and failing queens destroyed. A handy way of introducing virgin queens is by the smoke method. The old queen must first be removed from the hive that is to be requeened. The entrance is then contracted, and a few vigorous puffs of smoke are forced in at it. Then, before the bees have recovered from this treatment, the virgin queen is released at the entrance, piloted into the now queenless hive, and hastened therein by several more puffs of thick smoke. The hive is then closed altogether for about ten minutes, after which the entrance is once more opened slightly and left like this till the next day, when the full entrance can once more be allowed.

FINDING BLACK QUEENS.

It is a very difficult matter, even for experienced beekeepers, to find a black queen in a thickly populated colony by the usual method of looking over the frames. Much time and labour may be saved by adopting the sifting method. To do this, tack a queen-excluder on the bottom of an empty half-super; then nail on the excluder a piece of board about 4 in. wide and the length of the hive, so that its edge is flush with the side of the half-super. Now remove from the bottom-board the hive containing the queen to be found, placing it to one side. Put an empty super in its place on the stand, then over it the sieve or super with excluder. This should be placed so that the board on the bottom overlaps the hive below by about 4 in., which will leave a gap at the opposite side in which to replace the frames. Now place the hive over the sieve, lift out each frame with the adhering bees, starting from the nearest side, and quickly give each frame a sharp shake over the hive on the sieve so as to dislodge the bees. As each frame is done, place it in the hive below, sliding it along under the excluder; it will be gradually pushed along until it occupies its former position in the hive. When all have been done the remaining bees in the now empty hive may be dumped into the sieve. The bees will soon find their way down to the brood below, leaving the queen and the drones above the excluder, as they cannot get through the small holes. A little smoke will hasten the descent of the worker bees. The queen can then be found trying to get through to the brood below.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

TOBACCO-GROWING.

THE tobacco crop in the field will now be well established, and in many cases the plants will be of considerable size and covering most of their allotted space. Very little hoeing or cultivation will now be required, and the less traffic there is now among the plants the better. The success of the crop depends very largely on well-developed leaves free from all bruising and injury. This will be secured by disturbing the crop now as little as possible until compelled to go through it next

month, when the flower-buds will appear and the operation of topping has to be carried out. Meanwhile consideration might well be given to the curing-sheds and preparations for harvesting. Whether air curing, fire curing, or flue curing is to be done, the necessary supplies should now be ascertained and secured, the sheds cleaned up and repaired so that all sign of dampness and moulds are disposed of, and suitable arrangements made for the ventilation of every part of the building as required. One appliance that has been overlooked by some growers in the past is a suitable baling-press. A press of even the simplest description will ensure neat and rapid work when baling, and the delivery of the product in good condition. The broken leaf due to transportation in slack bales is excessive, and must be the cause of heavy financial loss.

TOMATOES.

The tomato crop under glass will now be in the middle of the harvesting-period, and packing and consigning fruit will keep the grower busy. To enable the top bunches to reach full development it is advisable to take steps to prevent the early attack of leaf-mould fungus, which develops rapidly in a humid, hot atmosphere. The tall, closely packed plants readily develop these conditions under glass, and great care is necessary in watering and ventilation.

The outside main crop will now be half-grown, and suckering and tying the plants to the supporting wires or sticks will take up a great deal of time. These operations compel an examination of each individual plant, and the opportunity might well be taken to note any sign of disease and any outstanding features of merit in the type of the plant. An early warning of trouble from disease is the main feature in the very best method of control, while in gardens where seed is saved for future sowing the selection must first be made of the parent plants. The selection of a few good fruits for seed from a box is an unsatisfactory method and a very common one. Of first importance is to select plants that are of good constitution, early maturing, and heavy bearing. These may be marked now, so that the pickers may reserve the fruit to allow it to reach full maturity for seed-saving. This work well repays the greatest care, as experience with tomatoes continually shows marked improvement or depreciation according to the amount of attention that is given to this important point. In case the matter is not dealt with again in these notes during the season it is as well to mention here the importance of keeping the seed from each plant separate, so that it may afterwards be sown separately, and thus a uniform strain eventually secured and maintained.

SMALL-FRUITS.

The berry-fruit harvest is now at its height. The supply generally is short, and, if well distributed, should meet a good demand. These valuable delicacies are in high favour, and few consumers usually have their requirements satisfied. The demand for syrups of this class of fruit is also increasing. The wooden buckets for consigning berries are expensive, and in many ways unsatisfactory. Reports to hand regarding the use of benzine-tins cut down to a suitable height and thoroughly lacquered show them to be a suitable container for jam fruits of this class.

To prune out the rank water-shoots in gooseberry-bushes is a timely attention. The red- and white-currant bushes will also benefit very much from a careful summer pruning at the present time.

THE VEGETABLE GARDEN.

The harvesting of early potatoes, peas, cabbage, cauliflower, and salads that is now taking place will leave land available for further cropping. The usual succession is the winter crops of celery, leeks, savoy cabbage, cauliflower, broccoli, and brussels sprouts. The young plants of these vegetables should now be about ready for lifting from the seed-beds at any time. In order that this planting may be finished early in the New Year the preparation of the land should proceed without delay, as the plants do best on cultivated land that has had time to settle down into a firm bed.

During the dry weather that is usual at this season these plants are often affected with the small green caterpillar of the diamond-backed moth, green aphis, and thrips, which often ruin a crop. The following spray is effective in defeating this attack: Take three teaspoonfuls of nicotine concentrate and 2 oz. arsenate of lead; dissolve and dilute each separately in a pint or two of water; mix them, and make up the quantity to 4 gallons. Apply this spray occasionally as required to the plants in the seed-bed, a special application being made a day or two before the plants are lifted for putting out in the field. As the insects referred to feed on the under side of the leaves, care must be taken to apply the spray to those parts. Once the plants are well established and the autumn rains commence the danger period is over, as the more humid atmosphere is detrimental to the pests and advantageous to the crops.

CELERY, ASPARAGUS, AND RHUBARB.

The increasing demand for celery makes it worth while to consider more wholesale methods of cultivation, such as are practised in America, where this crop is now grown in fields of considerable acreage, so great is the popular demand. The main crop is planted on the flat in rows 4 ft. or 5 ft. apart and 5 in. or 6 in. between the plants. The sticks are blanched by moulding them up with soil by means of an adjustable moulding-plough before the growth is completed. For summer crops the rows are closer, and 10 in. or 12 in. boards are placed along each side of the rows of plants for blanching them, or builder's paper is used. As strong leaf-growth of good texture is required of these plants, it is natural to find nitrogenous manures and potash the most suitable for growing the crop successfully.

Permanent beds of asparagus and rhubarb must now be allowed to recover from the hard treatment they have received by the cutting and pulling of the young growth throughout the spring months. A good dressing of fertilizers, and, if the weather is dry, a good soaking with water will greatly assist them. Where plantations of rhubarb have to be remade it is customary in some localities to do it at this season, lifting the plants, cutting the fleshy roots up into pieces with two good shoots in each, and replanting.

—*W. C. Hyde, Horticulturist.*

WEATHER RECORDS: OCTOBER, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather of October was remarkably wet, both in the amount of precipitation and the number of days, except in the Poverty Bay and Hawke's Bay districts and in Westland. From the 1st to the 12th the weather was most unsettled, and rain was recorded every day in most parts of the Dominion, but heaviest in the North.

On the 10th and 11th an ex-tropical disturbance passed over the North Island, and snow and hail fell on higher levels in the North as well as in many places in the South Island. A wintry snap followed, and a sharp frost was experienced on the morning of the 13th. This did a considerable amount of damage to tender spring growth.

From the 9th to the 12th rainfall was remarkably heavy in the basin of the Waikato River, and the highest flood recorded for nineteen years continued for several days. There were magnetic storms about the middle of the month, associated with sun-spots. Many people tried to account for the preceding weather by reference to these phenomena, but there does not, so far, appear to be any scientific relationship useful to the Meteorologist.

An extensive westerly disturbance held sway during the last week of the month, but was complicated by a well-defined cyclonic system which invaded the larger area of low pressure. The centre of this storm passed through Cook Strait on the 28th. There were some heavy rainfalls, accompanied by thunderstorms, in the South Island at the close of the month; and Westport experienced a flood on account of heavy rain and melting snows at the source of the Buller River.

Sunshine was below the average for the month. Barometric pressure was everywhere below the mean for the month, and was only above the normal about the 23rd and 24th.

The returns so far show a difference in temperature—the North Island being somewhat warmer, and the South Island rather cooler, than usual at this time of the year.

RAINFALL FOR OCTOBER, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	9·04	16	2·16	4·48
Russell	8·69	15	2·01	3·27
Whangarei	10·50	18	1·74	4·58
Auckland	7·55	21	2·01	3·64
Hamilton	8·24	25	1·94	4·04
Kawhia	10·06	26	2·28	5·28
New Plymouth	12·13	23	2·03	5·48
Riversdale, Inglewood	21·08	26	3·52	10·37
Whangamomona	15·58	19	2·50	9·11
Tairua	7·24	9	2·20	6·89
Tauranga	8·86	24	2·12	5·25
Maraehako Station, Opotiki	7·72	15	1·58	5·50
Gisborne	2·20	13	0·80	2·80
Taupo	8·03	19	1·79	4·38
Napier	1·74	16	0·46	2·30
Maraekakaho Station, Hastings	1·97	15	0·56	3·09
Taihape	3·68	19	0·73	3·99
Masterton	5·27	17	1·26	3·32
Patea	9·60	23	1·33	4·11
Wanganui	7·36	19	1·88	3·65
Foxton	7·09	15	2·26	2·92
Wellington	6·72	20	2·03	4·15

RAINFALL FOR OCTOBER, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
South Island.				
	Inches.		Inches.	Inches.
Westport	7·10	27	1·62	6·97
Greymouth	7·30	23	1·37	10·66
Hokitika	10·33	24	1·39	11·84
Ross	9·61	19	1·42	15·16
Arthur's Pass	18·36	17	5·99	20·99
Okuru, Westland	14·86	22	3·14	15·37
Collingwood	16·68	22	2·81	11·03
Nelson	4·83	16	0·67	3·59
Spring Creek, Blenheim	4·38	13	0·95	2·39
Tophouse	6·66	22	1·25	5·80
Hanmer Springs	6·45	18	1·89	3·15
Highfield, Waiau	4·73	13	1·44	2·46
Gore Bay	4·68	14	1·34	1·80
Christchurch	2·84	16	1·09	1·68
Timaru	3·42	16	0·90	1·95
Lambrook Station, Fairlie	3·26	13	0·64	2·00
Benmore Station, Clearburn	3·20	16	0·93	2·09
Oamaru	3·83	19	1·61	1·68
Queenstown	3·97	15	1·42	3·60
Clyde	2·61	11	1·05	1·58
Dunedin	6·05	20	2·03	3·09
Wendon	3·65	12	1·51	2·50
Gore	3·51	16	1·28	3·37
Invercargill	4·34	17	1·12	4·44
Puysegur Point	5·82	18	1·58	8·16

—*D. C. Bates, Director.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 9th September to 4th November, 1926, include the following of direct agricultural interest :—

No. 54892 : Milking-machine teat-cup ; R. Caldwell, Whakamara. No. 55008 : Cow-cover ; H. B. Gibson, Frankton Junction. No. 55121 : Milking-machine vacuum tank ; O. Randrup, Hamilton. No. 55379 ; Milk straining, atomizing, and cooling apparatus ; National Dairy Association of New Zealand, Wellington. No. 56198 ; Plough-lift ; P. and D. Duncan, Ltd., Christchurch. No. 56809 : Flax-treatment ; S. H. Maddren, Christchurch. No. 55306 : Curd-mill driving-gear ; Union Foundries, Ltd., Stratford. No. 55410 : Plough-lift ; E. C. Gaisford, Bull's, and A. H. Dales, Marton. No. 55188 : Belly-band ; W. J. Mitchell, Hindon. No. 56500 : Rabbit-trap ; J. M. de Sorie, Randwick, N.S.W. No. 56541 : Cheese-reconstituting ; J. R. Butland, Auckland. No. 56956 : Sheep-shearing-machine driving-mechanism ; A. G. Hutchinson and C. S. McCabe, Wellington. No. 57123 : Sheep-shears ; Chicago Flexible Shaft Co., Chicago, U.S.A. No. 57168 : Harrow ; H. S. Pearson, Springston.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price 1s.

Rabbit Districts.—By Order in Council gazetted on 7th October, Part III of the Rabbit Nuisance Act, 1908, is declared not to be in operation in the Mairoa Rabbit District, Auckland.

THE VETERINARY SURGEONS ACT.

THE full text of this measure—providing for the registration of veterinary surgeons—passed in the last session of Parliament, is as follows :—

1. This Act may be cited as the Veterinary Surgeons Act, 1926, and shall come into force on the first day of January, nineteen hundred and twenty-seven.

2. In this Act, unless the context otherwise requires, "Board" means the Veterinary Surgeons Board constituted under this Act ; "Registrar" means the Registrar appointed under this Act.

3. (1.) For the purposes of this Act there shall be appointed a Board to be called the Veterinary Surgeons Board.

(2.) The Board shall consist of—(*a*) The Registrar, who shall be appointed by the Governor-General from among the veterinary surgeons in the employment of the Department of Agriculture ; (*b*) one person to be appointed on the recommendation of the Minister of Agriculture ; and (*c*) two veterinary surgeons to be appointed on the recommendation of the incorporated society known as the New Zealand Veterinary Association (Incorporated).

(3.) The members of the Board other than the Registrar, who shall hold office during pleasure, shall be appointed by the Governor-General for a period of three years, save that any such member may be reappointed, or may be at any time removed from office by the Governor-General for disability, insolvency, neglect of duty, or misconduct, or may at any time resign his office by writing addressed to the Registrar: Provided that, after the expiration of twelve months from the commencement of this Act, no person shall be appointed or shall continue to be a member of the Board as one of the veterinary surgeons appointed on the recommendation of the New Zealand Veterinary Association (Incorporated) unless he is registered under this Act.

(4.) If any member of the Board other than the Registrar dies, resigns, or otherwise vacates his office, the vacancy so created shall, within two months after the occurrence thereof, be filled in the manner in which the appointment to the vacant office was originally made. Every person so appointed shall hold office for the residue of the term for which his predecessor was appointed.

(5.) The members of the Board, other than the Registrar, shall be paid such allowances as may be lawfully appointed and all travelling-expenses reasonably incurred by them in respect of attendance at meetings of the Board.

(6.) In the absence of the Registrar from any meeting of the Board any officer of the Department of Agriculture may be appointed by the Registrar to act as his deputy, and while so acting shall for the purposes of this Act have all the powers of the Registrar.

4. (1.) The Registrar shall be the Chairman of the Board.

(2.) Meetings of the Board shall be held at such times and places as the Board or the Chairman may appoint.

(3.) The Board may regulate its procedure in such manner as it thinks fit.

5. The Registrar shall keep in his office a book, to be called the Register of Veterinary Surgeons, in which shall be entered the names of all persons registered as veterinary surgeons under this Act, together with such other particulars in relation thereto as may from time to time be prescribed.

6. (1.) Every person shall, on payment of the prescribed fee, be entitled to be registered as a veterinary surgeon under this Act who satisfies the Board that he is of good character and repute, and that—(*a*) He is a member of the Royal College of Veterinary Surgeons at London ; or (*b*) he is a graduate in veterinary medicine and surgery, or the holder of a veterinary diploma, of any veterinary school or other institution (not being the Royal College of Veterinary Surgeons aforesaid) by the statutes or rules of which a course of not less than four years' study of the appropriate subjects is required before a veterinary degree or diploma, as the case may be, can be conferred, and which is recognized by the Government of the country in which it is established and by the Board as a proper and efficient teaching institution ; or (*c*) not being qualified to be registered under either of the two last preceding paragraphs he was employed or was practising as a veterinary surgeon in New Zealand at the date of the commencement of this Act, and that

he is a graduate in veterinary medicine and surgery, or the holder of a veterinary diploma, of a veterinary school or other institution by the statutes or rules of which a course of three years' study of the appropriate subjects is required before a veterinary degree or diploma, as the case may be, can be conferred, and which is recognized by the Government of the country in which it is established and by the Board as an efficient teaching institution.

(2.) No person shall be registered as a veterinary surgeon under paragraph (*c*) of the last preceding subsection unless application for registration is made within one year after the commencement of this Act.

7. (1.) Every application for registration under this Act shall be in writing addressed to the Board, and all the facts set forth in the application shall be verified by statutory declaration of the applicant.

(2.) No entry in the register of the name of any person shall be made by the Registrar without the direction in writing of the Board.

8. Every person registered as a veterinary surgeon under this Act shall, on payment of the prescribed fee, be entitled to receive a certificate of registration under the hand of the Registrar.

9. Every person who makes any false or fraudulent representation, or produces to the Board or the Registrar any false certificate or testimonial, for the purpose of securing his registration under this Act commits an offence, and is liable to a fine of fifty pounds.

10. The Board may cause to be removed from the register the name of every registered veterinary surgeon who has been registered in error, or who is convicted of any offence punishable by imprisonment and dishonouring him in the public estimation, or who has been guilty of such improper conduct as renders him, in the opinion of the Board, unfit to be registered under this Act.

11. (1.) Every person whose application for registration has been declined by the Board, or whose name has been removed from the register, may, within three months after notice of such refusal or removal has been communicated to him by the Registrar, appeal in the prescribed manner to a Board of Appeal, consisting of a Magistrate and two assessors, appointed in accordance with regulations under this Act.

(2.) The Board of Appeal shall thereupon hear the appeal, and may either confirm the decision of the Board or order the registration of the appellant or the restoration of his name to the register, and the determination of the Board of Appeal shall be final and conclusive.

12. On or before the thirty-first day of March, nineteen hundred and twenty-eight, and in each year thereafter, every registered veterinary surgeon who desires to have his name published in the *Gazette* as such shall forward to the Registrar the prescribed fee for such publication, together with the name and address of the applicant and such other particulars as may be required by the Board.

13. (1.) The Registrar shall, in the month of April, nineteen hundred and twenty-eight, and thereafter in the month of April in every year, cause to be published in the *Gazette* a list of the names, with prescribed particulars, of such registered veterinary surgeons as have applied to have their names so published and have paid the prescribed fee.

(2.) The *Gazette* containing such list shall, unless the contrary is proved, be sufficient evidence in all judicial proceedings that on the thirty-first day of March immediately preceding the date of the *Gazette* every person whose name appears therein as a registered veterinary surgeon was duly registered as such, and also that every such person has continued to be so registered at all times after the said thirty-first day of March and before the date of the next publication in the *Gazette* of the list of registered persons.

14. (1.) Save as provided in the next succeeding subsection, every person commits an offence, and is liable to a fine of twenty pounds, who, not being a registered veterinary surgeon, takes, uses, or adopts the name, title, or description of veterinary surgeon, veterinarian, or veterinary practitioner, or uses or causes to be used in connection with his business, trade, calling, or profession any written words, titles, initials, or abbreviation of words, titles, or initials intended to cause, or which may reasonably cause, any person to believe that he is a registered veterinary surgeon.

(2.) Any person who has practised as a veterinary surgeon in New Zealand for not less than ten years immediately prior to the commencement of this Act

may, notwithstanding that he may not be qualified to be registered under this Act, continue in practice, and may use in connection with his business the designation of "veterinary practitioner," if he lodges his name with the Minister of Agriculture not later than twelve months after the commencement of this Act, and satisfies him that he has been practising as aforesaid, and that he is of good character and repute.

(3.) In every prosecution for an offence against this section the burden of proving that the defendant, at the time when the offence was committed, was registered under this Act shall lie upon the defendant.

15. All fees and other moneys paid under this Act shall be paid into the Public Account and shall form part of the Consolidated Fund, and all expenses incurred in respect of the administration of this Act shall be paid out of moneys to be from time to time appropriated by Parliament for the purpose.

16. The Governor-General may from time to time, by Order in Council, make regulations—(*a*) Prescribing forms of application for and certificates of registration under this Act; (*b*) prescribing the fees payable in respect of registration under this Act, and also prescribing fees for the issue of certificates of registration and for the annual publication in the *Gazette* of the name of any registered veterinary surgeon; (*c*) providing for the appointment of assessors and the conduct of appeals under section eleven hereof; (*d*) generally providing for such other matters as, in the opinion of the Governor-General in Council, are necessary or expedient for the effective administration of this Act.

BOVINE TUBERCULOSIS.

THE occurrence of this disease in New Zealand is referred to as follows in the annual report of the Live-stock Division for 1925–26 :—

"The condemnations of cattle on clinical examination and as the result of the tuberculin test numbered 4,692, being a decrease on the previous year's figures of 189. The distribution of the stock condemned was as follows: Auckland, 2,852; Wellington (including Taranaki and Hawke's Bay), 1,308; Canterbury-West Coast, 367; Otago-Southland, 165. The use of the tuberculin test for diagnostic purposes was availed of to the number of 4,725 head of cattle. An analysis of the results of the examination of carcases on slaughter at freezing-works and abattoirs during the year discloses a decrease of 0·35 per cent. in the number of cattle found affected with tubercular disease. The number of cattle (excluding calves) examined was 364,572, of which 18,770, or 5·16 per cent., were found to be affected in varying degrees, a considerable number only very slightly. In the case of swine, a decrease of 0·50 per cent. is disclosed. The number of swine examined was 366,269, of which 31,420, or 8·57 per cent., were found to be affected in varying degrees, and, as in the case of cattle, a considerable number only slightly. These figures indicate that an improvement on the past year has taken place, which it is trusted will be maintained and improved on in the years to come. While this disease is responsible for considerable monetary loss to producers in this Dominion, it is nevertheless satisfactory to note that it is held in check by our system of inspection and condemnation of all the live animals showing symptoms of the disease, and also the free use of the tuberculin test for diagnostic purposes. As has been previously mentioned, bovine tuberculosis is most prevalent in low-lying wet or swampy areas, of which there are many in the Auckland Province, and until drainage and better conditions generally can be introduced to those areas the incidence of tuberculosis may be expected to continue."

Area under Potatoes.—The Government Statistician estimates the area under potatoes this season (1926–27) as 5,550 acres in the North Island and 18,950 acres in the South Island, or a total of 24,500 acres. The corresponding final figures for the 1925–26 season were 5,438, 18,046, and 23,484 acres respectively. Only holdings of 1 acre and over outside borough boundaries are covered by these figures. A fair aggregate area of potatoes is grown on the smaller holdings and within boroughs.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

BONE-CRUSHING ON THE FARM.

"FARM ECONOMIST," Waitekauri :—

Is there any known method by which bones can be profitably made into manure on the farm? Is it possible to buy a small mill capable of dealing with a few hundredweight, and, if so, at what price? Water-power in plenty is available.

The Fields Division :—

The first thing to do in the process of reducing bones to a condition suitable for application to the soil is to degrease them. This can be done in a somewhat crude way by boiling in an open vessel. It is advisable to acidulate the water in which the bones are boiled by the addition of a small quantity of sulphuric acid—say, $\frac{3}{4}$ per cent. of the weight of bones taken. The bones thus treated should, when dried, be crushed. Bone-crushers can be procured at prices varying up to about £5. A No. 1 Bentall's crusher will do 3 to 5 bushels per hour. It is a hand machine, and the cost is £3 15s. It will reduce the bones to the fineness of flour. The No. 4 Kornking will do 10 to 15 bushels per hour; $1\frac{1}{2}$ horse-power is necessary to run this machine, and the cost is £5.

CALF-FEEDING.

W. BELL, WOODSIDE :—

I am rearing four calves, and have till now been feeding them with 6 pints of whole milk per head twice daily. They are now receiving a similar quantity of skim-milk with one dessertspoonful of pure olive-oil added. Can you tell me if this is an effective substitute for the whole milk, and, if not, what quantity of oil would be required?

The Live-stock Division :—

It is advisable to supplement skim-milk by adding an allowance of linseed. This can be done by soaking whole linseed overnight in water and boiling it for twenty minutes in the morning to the consistency of a porridge. Give each calf a tablespoonful daily, gradually increasing the allowance to two and three spoonfuls. As this porridge is liable to sour, sufficient to last only two days in summer and three days in winter should be made at one time. It is also necessary in rearing calves to provide clean, fresh pasture.

WORMS IN HORSES.

"SUBSCRIBER," Otane :—

Kindly advise me of a good cure for worms (of a small red species) in horses; also causes and prevention of same.

The Live-stock Division :—

Worm infestation in horses is caused by their taking in the eggs or larvæ with their food. These come to maturity within the body of the animal, but do not actually cause much trouble unless its condition has been pulled down from other causes. Treatment along the following lines should prove effective in remedying the trouble: Give a bran mash instead of the usual feed in the evening, followed by a drench next morning consisting of turpentine, 1 oz., in linseed-oil, 1 pint. Food should be withheld altogether for the day, and the next morning a physic ball consisting of 6 to 8 drachms of aloes (according to the size of the horse) should be given. A good nourishing diet, light at first, should be now given, as it is essential to build up the strength of the horse so that it may combat further infestation.

GUMMING OF CHERRY-TREES.

"GARDENER," Scargill :—

I have some cherry-trees which have a kind of blight. Gum oozes from them in places, and the parts affected afterwards die off. Could you tell me of a cure ?

The Horticulture Division :—

The gumming of cherry-trees is often caused by any one of a number of fungous diseases attacking the tree, or by some physical injury or abrasion. Treatment in such cases consists of suitable spraying after pruning away the diseased growths, or trimming the wounds and applying a suitable dressing. In other cases, however, gumming takes place without any of these exciting causes. The trouble is then known as gummosis, and is a physical disease the cause of which is unknown, but generally considered to be due to wet, rich soil, unsuitable stocks, or varieties unsuitable to the locality. In very bad cases the trees should be dug out and discarded. In other cases the worst wounds may be trimmed and dressed with tar or paint, and a good dressing of lime applied to the soil. Very often, also, vertical incisions are made on the bark with considerable benefit.

BLACKBERRY-SEED AND BIRDS.

G. W., Rawene :—

Please tell me whether blackberry-seed when eaten by pheasants is digested or passed in the excreta in a condition to germinate.

The Live-stock Division :—

The fruit of the blackberry-plant gives sustenance to bird-life mainly by reason of its fleshy integuments, and although some of the actual seed itself may become dissolved and assimilated in the process of digestion there is little doubt that quantities of it are passed in the excreta in such a condition as to allow of germination. In nature bird-life plays a large and valuable part in the dissemination of vegetable growths, and to the native birds of this country is due in no small measure the credit of clothing in pristine luxuriance its broad spaces with the magnificent milling-timbers now, unfortunately, so sadly depleted.

LEAF-MOULD FROM PINE-NEEDLES.

R. F. G., Blenheim :—

Please inform me the value of leaf-mould made from the "needles" of *Pinus insignis*. Could it be used for the same purposes as leaf-mould made from the leaves of deciduous trees ?

The Horticulture Division :—

Leaf-mould from pine-needles has often been used as an ingredient of potting-soils, but our experience is that it has not proved satisfactory.

MAKING PIT ENSILAGE.

"SILAGE," Manaia :—

I am considering making silage in a pit this season, and would like to know if 6 acres of lucerne and oats would be sufficient material. It is not much of a crop at present, the lucerne being ten months old. I thought, if the lucerne and oats were not enough, to cut a portion of a hay paddock. The pit is 13 ft. by 18 ft., and 12 ft. deep. If I removed the earth about February, could I put another cut of lucerne on without doing any harm ?

The Fields Division :—

Six acres of lucerne and hay should just about fill your pit, but should the crop be light and the pit not full it would be good practice to cut a portion of an oat crop or other surplus grass to fill the pit. The earth could be removed

from the pit in February, and a second cut of lucerne put on. If you decide to do this and have any old sacks available, cover the material in the pit with these before applying soil. When you remove the soil there is sure to be some material on the top that has spoilt. This should be thrown out before the fresh material is put on.

REVIEW.

"WEEDS OF NEW ZEALAND."

A NUMBER of excellent books have been written from time to time in England, America, Australia, &c., dealing with the identification of weeds and their control, and on comparing these it will be found that a large majority of the plants are of European origin, and that a surprising number are common to most temperate countries, including New Zealand. Not long ago many inquiries made by farmers in this country about weeds would have been answered with the statement that such-and-such an English text-book existed which would make it easy to identify any weeds likely to be met with here, and would give full instructions how to control them.

It is now beginning to be realized, however, that though certain of the weeds of two countries may be known to be the same from the systematic botanist's point of view, the mere identification of a weed with a European one, for instance, is only the first step in obtaining an insight into the best control methods to be used against it in a country entirely different in climate, &c. There are no rule-of-thumb methods that can be applied equally well to a weed wherever it exists, and it is to the agricultural workers of each country that we must look for knowledge of the weeds of their land as regards their relative harmfulness and the best means of controlling them.

Much has been written from time to time on the weeds of this country from the New Zealand farmer's point of view, but "Weeds of New Zealand, and how to eradicate them," by F. W. Hilgendorf, M.A., D.Sc., F.N.Z.Inst. (Whitcombe and Tombs, Limited; 6s. 6d.), may be said to be the first real attempt to gather together all this information between the two covers of a book.

The author is generous in his acknowledgments, and makes no claims for his work as the outcome of original research. It is not revolutionary in its nature—no new principles in the art of weed-control are involved—and, considering the great changes that are being made from year to year over the face of the country, it is likely enough that many of the statements made by the author will need revision before long. But the very workers that bring this about will, if they are fair-minded, be the first to acknowledge their indebtedness to the book. However, such a work as this is primarily addressed to the man now on the land, and he will undoubtedly find that it answers clearly many of the questions that confront him.

The main body of the book comprises a series of descriptions of the important weeds of the Dominion, each being supplemented by notes showing how it may best be controlled. There are two chapters that are likely to prove of use in the identification of weeds to those who know nothing of the classification of plants by families. In one of these (Chapter IX) the weeds are arranged in groups according to the colours of their flowers, and though, as the author says, there is a considerable degree of indefiniteness about such an arrangement, it should prove useful in conjunction with the next chapter, where there is a tabular grouping of weeds (under their common names, as in the preceding chapter), their relative abundance in eighteen different districts being recorded.

Many of the most important weeds are illustrated, while there are also a number of enlarged photographs of weed-seeds. It is a matter of some regret in regard to the latter that the degrees of magnification of different kinds of seeds shown on the same page should not have been specified, as often quite a wrong impression is given of their relative sizes, even though a note of explanation is printed on pages where this occurs.

E. H. A.

Noxious-weeds Order.—The Whangaroa County Council has declared cut-leaved psorolea and Cape honey-flower to be noxious weeds, under the Act, in that county.

THE SEASON'S LAMBING: NORTH ISLAND ESTIMATE.

FROM information furnished by Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 84·35 per cent. With 7,503,200 breeding-ewes in the North Island, as shown in the 1926 sheep returns, the number of lambs is estimated at 6,329,338. South Island and Dominion estimates will appear in next month's issue of the *Journal*.

ESTIMATED AREAS UNDER WHEAT AND OATS.

THE following estimates of the areas under wheat and oats in the Dominion for the current season have been issued by the Government Statistician at date 26th October, the figures being based on the usual card census: Wheat—North Island, 3,500 acres; South Island, 218,500 acres: total, 222,000 acres. Oats—North Island, 35,000 acres; South Island, 370,000 acres: total, 405,000 acres. The corresponding final totals for the preceding season (1925–26) were 153,248 acres of wheat and 367,205 acres of oats. Wheat, therefore, has an estimated increase in area this season of 68,752 acres, and oats an increase of 37,795 acres. The areas under the different main varieties of wheat grown are specified as follows: Tuscan or Longberry, 151,728 acres; Hunter's (various), 28,373 acres; Velvet or Pearl, 13,402 acres.

FORTHCOMING AGRICULTURAL SHOWS.

Thames Valley A., P., and H. Association: Te Aroha, 23rd and 24th November.
Winton A. and P. Association: Winton, 24th November.
Otago A. and P. Society: Dunedin, 24th and 25th November.
Egmont A. and P. Association: Hawera, 24th and 25th November.
Whangarei A. and P. Society: Whangarei, 24th and 25th November.
Stratford A. and P. Association: Stratford, 1st and 2nd December.
Wyndham A. and P. Society: Wyndham, 10th December.
Horowhenua A. and P. Association: Levin, 25th and 26th January, 1927.
Rangitikei A. and P. Association: Taihape, 26th and 27th January.
Helensville A. and P. Association: Helensville, 29th January.
Golden Bay A. and P. Association: Motupipi, 1st February.
Feilding A. and P. Association: Feilding, 1st and 2nd February.
Woodville A. and P. Association: Woodville, 4th and 5th February.
Omaha and Pakiri A. and H. Association: Leigh, 5th February.
Kawakawa A. and P. Association: Kawakawa, 5th February.
Te Puke A. and P. Association: Te Puke, 9th February.
Dannevirke A. and P. Association: Dannevirke, 9th, 10th, and 11th February.
Pahiatua A. and P. Association: Pahiatua, 12th February.
Rodney Agricultural Society: Warkworth, 12th February.
Masterton A. and P. Association; Solway, 15th and 16th February.
Whakatane A. and P. Association: Whakatane, 16th February.
Te Awamutu A., P., and H. Association: Te Awamutu, 16th February.
Buller A. and P. Association: Westport, 18th and 19th February.
Marton A. and P. Association: Marton, 23rd February.
Franklin A. and P. Association: Pukekohe, 25th and 26th February.
Waikato Central Agricultural Association: Cambridge, 2nd and 3rd March.
Mongonui County A. and P. Association: Kaitaia, 5th March.
Morrinsville A., P., and H. Society: Morrinsville, 9th March.
Amuri A. and P Association: Waiau, 9th March.
Taranaki Metropolitan Agricultural Society: New Plymouth, 9th March.
Mayfield A. and P. Association: Mayfield, 19th March.
Temuka A. and P. Association: Geraldine, 7th April.
Mackenzie County A. and P. Society: Fairlie, 18th April.

Association secretaries are invited to supply dates and location of their shows for publication in this list.

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THE GRASSLANDS OF NEW ZEALAND.

SERIES II. NORTH ISLAND HILL COUNTRY.

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

GRASSES AND CLOVERS FOR HILL COUNTRY—*continued.*

(5.) Paspalum *(Paspalum dilatatum).*

IN the North Island, over the major portion of the Auckland Province, paspalum occupies a position among the permanent-pasture species corresponding somewhat to that held by cocksfoot farther south. Paspalum, however, so far as soil-types are concerned, has a much wider range than cocksfoot. It will thrive on extremely wet soils, such as in a waterlogged undrained swamp, or on areas subject to periodical inundation even by brackish water; on dry sands and light open volcanic soils; on loose unconsolidated soils, such as peat swamps; and on heavy consolidated clays—even the heaviest of the northern gum-land type. It tolerates shady conditions well, but also persists on exposed sunny knolls. It has a very wide range of adaptability so far as the quality of a soil is concerned. Normally it is a demander of a high state of soil-fertility, ranking in this respect even above cocksfoot, but in the case of paspalum a reduction in fertility does not lead to an opening-up of the pasture sward; the turf remains closed even though the production of herbage may fall away almost to nothing. Paspalum is one of the greatest pioneering grasses for many of the rougher soil-types, where in the ordinary course of events it would take years of preparation of the land to bring about conditions favourable for persistence and thriving of the better-class English grasses.

In this article it is the intention to deal more specifically with paspalum in relation to the hill country, but many of the principles that apply to hill-country grasslands apply equally well to the low-land soils so far as the intrinsic value and management of the pasture plants are concerned.

The two big factors that limit the value and wholesale application of paspalum in New Zealand are (1) its high soil-fertility requirement, and (2) its rather high temperature requirement.

As before stated, in fertility requirement paspalum ranks above cocksfoot, and as a matter of fact it comes well up to perennial rye-grass and meadow-foxtail standard in this respect; but these two grasses when sown on the same rich soil along with paspalum are easily able to maintain a dominant position in the pasture, owing to their seasonal-growth range being much wider than is that of paspalum. In such pastures, however, there may frequently arise a summer seasonal paspalum dominance, particularly so when the pasture is allowed to get away rank. It is on soils, however, just not quite good enough for perennial rye-grass — that is, on typical cocksfoot country — that paspalum shows up as a marked dominant in the sward (Fig. 88). So dominant, in fact, may paspalum become, particularly under poor utilization, that all other associate species sown virtually disappear entirely from the pasture. The writer claims that under most soil conditions it is possible to keep a mixed association, and such should be the aim of every farmer on soils capable of growing paspalum (Fig. 89). One hears so often of the danger of paspalum getting away and taking complete possession of the land; but because a grass produces so much feed that utilization problems arise, demanding skill on the part of the farmer successfully to deal with the big bulk produced, surely this is no reason why that grass should be condemned! Rather must one put down that state to a fault in the pasture-management rather than to a defect of the grass itself.

Normally paspalum is an extremely high producer—in fact, the writer would say offhand that the possibilities for production are greater in paspalum than in any other grass one could mention. The great disadvantage with paspalum, however, is that its yield is not spread evenly over the twelve months, as is the case with perennial rye-grass. Then again, perennial rye-grass is an English grass, and farmers in New Zealand do pride themselves on being able to say that their pasture consists solely of English grasses, irrespective of how poorly such grasses may be doing.

In regard to the rather long dormant period of paspalum, this may be turned to quite good advantage, for it is possible during this period to stimulate the associate species and thus to maintain a mixed association. Farmers in colder areas are generally louder in their condemnation of paspalum than is the case in warmer districts, for the reason, they say, that paspalum is good only for a few months in the summer. As a matter of fact, it appears to the writer that under conditions too cold for paspalum to thrive only in the heat of summer there should be no difficulty whatsoever in keeping a mixed association throughout the [illegible]ajor portion of the year. This is particularly true of most are[illegible] [illegible]thin the Auckland Land District (South Auckland). In this di[illegible] the [illegible]ing that should decide whether or not paspalum should [illegible]uded in the permanent grassland mixture is whether during th[illegible]mer there is a sufficiency of growth from this grass to warra[illegible] The more the paspalum is inclined to get away rank in th[illegible] summer, and the mor[illegible] inclined the grass is to spread from seed, the more should it be used as a

constituent of permanent grassland. The fact that paspalum has a longer winter dormant period farther south than it has in the north should not preclude its use in mixtures. Under proper management and high fertility upkeep paspalum would not become dominant over any area where its dormant period is of long duration, and, as a matter of fact, the longer the dormant period of paspalum the easier it is to keep associated with it other grasses and clovers.

With paspalum this mixed association is of great importance, whether it be on the hill or on the flat, and too much stress cannot be laid on the necessity of so managing conditions that pure paspalum pasture is avoided. Increasing dominance of paspalum, resulting finally in pure paspalum pastures, is almost entirely due to management. In two ways do the associate species become eliminated from or reduced in the sward: (1) By an overdevelopment of the paspalum

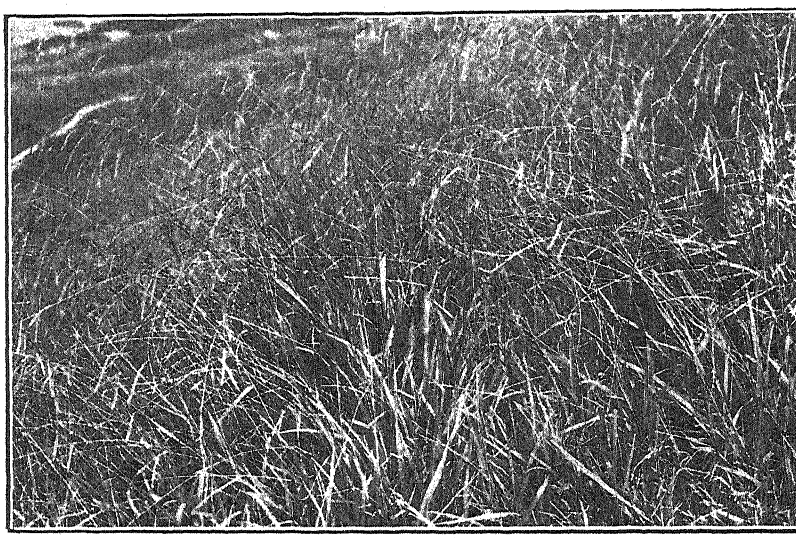

FIG. 88. PASPALUM ON HILL COUNTRY, NORTH AUCKLAND (KAIHU VALLEY), GROWING STRONGLY ON LAND NOT GOOD ENOUGH FOR RYE-GRASS.

The paspalum here has beaten cocksfoot for the position of dominant, a fair indication that paspalum is capable of producing on this soil more feed than cocksfoot could under the same conditions. Compare with Fig. 64 of this series.

[*Photo by E. Bruce Levy.*

growth during its peak period of production, resulting in a smothering-out of the essential bottom grasses and clovers (Fig. 90); (2) by a reduction of soil-fertility bringing about conditions too poor for the associate species to thrive, and resulting finally in a stunted, matted, sod-bound state of the paspalum itself (Fig. 91). Paspalum, like cocksfoot, is essentially a top grass. When allowed to get away it produces a great bulk of leafy foliage, which casts so dense a shade in the bottom of the pasture that all bottom grasses and clovers—perennial rye-grass, crested dogstail, white clover, &c.—are smothered out.

Lotus major stands the cover to some extent, as also do certain annuals, particularly Lotus hispidus and subterranean clover. These

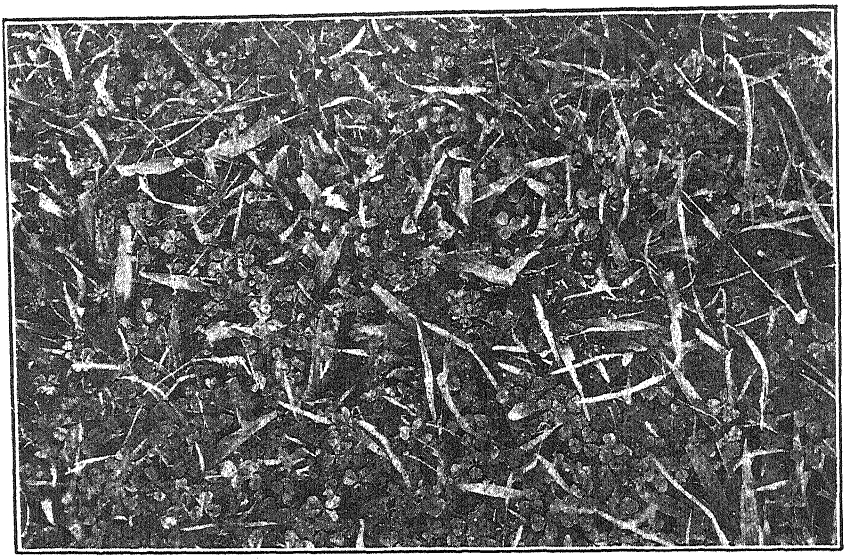

FIG. 89. PASPALUM, WELL UTILIZED, RETAINING A MIXED ASSOCIATION (RUAKURA).

Under good utilization conditions it is quite possible to keep a mixed pasture. The richer the soil the better the type of associate species that persist and thrive. Here subterranean clover, cocksfoot, crested dogstail, and a little rye-grass are nicely mixed in with the paspalum. [*Photo by E. Bruce Levy.*

FIG. 90. PASPALUM GROWTH ALLOWED TO GET AWAY RANK (WAIROA, HAWKE'S BAY).

Under poor utilization paspalum, where conditions are suitable for its growth, creates so much shade in the bottom of the pasture that virtually all associate species are smothered out and pure paspalum pastures result.

[*Photo by W. D. Reid*

annual clovers are very early spring seeders, and for the most part, particularly on the poorer soils, have made their seasonal growth and have ripened their seed before rank growth of paspalum commences in the summer (Fig. 92). The seeds of these annuals lie dormant in the dense shade of the rank paspalum growth until this ceases and is cleaned up in the autumn, when once more the annuals establish and furnish quite good feed throughout the winter and early spring. On high-class soils, however, better associate grasses than these annual clovers should be the aim of every paspalum-farmer, and it may be repeated that on the average-quality soils ranging up to the best-quality soils it is possible to so manage the paspalum pasture that perennial rye-grass, crested dogstail, and white clover can be retained indefinitely as associate species to paspalum. It is of little value having cocksfoot associated with paspalum in North Auckland, for the seasonal growth of this grass is not essentially different from that of paspalum. In seed-mixtures, however, some cocksfoot is generally included, and this practice is certainly sound south of Auckland City.

So far as the soil-fertility requirement of paspalum is concerned, and the bearing soil-fertility has on the associate species, it has been pointed out in previous articles that rye-grass, cocksfoot, crested dogstail, white clover, &c., in themselves demand a high state of soil-fertility apart from being asked to associate well with a ravenous grass like paspalum. In growth-form paspalum is a deep-rooting grass, and its crown and rooting system is below ground. Artificial manure applied as a top-dressing will become available to surface-feeding grasses and clovers—rye-grass, cocksfoot, white clover, &c.—sooner than it will in the case of paspalum. Hence top-dressing paspalum pastures tends to a rapid increase of associate species, provided always the paspalum growth is not rank.

A reduction in fertility is generally reflected in a dwindling of the associate grasses and clovers, and in a considerable reduction in the amount of growth produced by the paspalum itself. The foliage becomes stunted, often taking on quite a purplish tinge, and at this stage is quite unpalatable to stock. Owing, however, to the growth-form of the plant there does not result, as in the case of tussock-forming grasses like cocksfoot, rye-grass, &c., an opening-up of the pasture turf due to contraction in size of the tussock. Paspalum is a close mat-former, the plant spreading outward to form this mat by the production of short tillers arising from the underground crown. Under hard conditions this crown appears to work up above ground, and the tillers then arise at ground-level from the under-surface of the old stunted shoots above. In either case the ultimate result of a depletion of soil-fertility is the formation of a more or less pure turf so stunted and sod-bound that virtually no feed is produced from the paspalum itself, and practically the conditions are too hard for any associate species to thrive (Fig. 91).

This sod-bound state in paspalum is an argument often put forward against the use of the grass, but the writer must again affirm that this state is but the reflex of the conditions existing in the soil upon which the paspalum is growing. Paspalum will not become sod-bound while a plentiful supply of plant-food remains available in or is annually

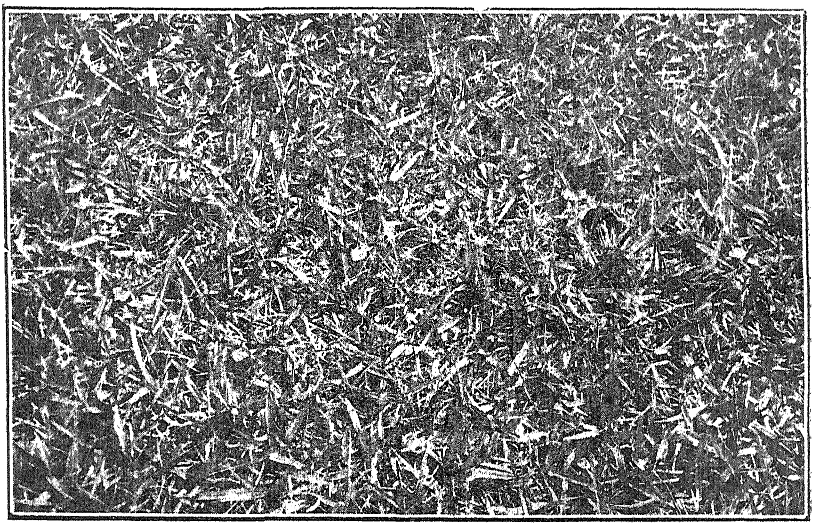

FIG. 91. SOD-BOUND PASPALUM TURF SHOWING FULL SEASON'S GROWTH (NORTH AUCKLAND).

Here a reduction in fertility has resulted in a dying-out of the associate species, and a dwindling of paspalum to a low producing and most unpalatable plant. Note that although paspalum has dwindled extremely there is no opening up of turf.

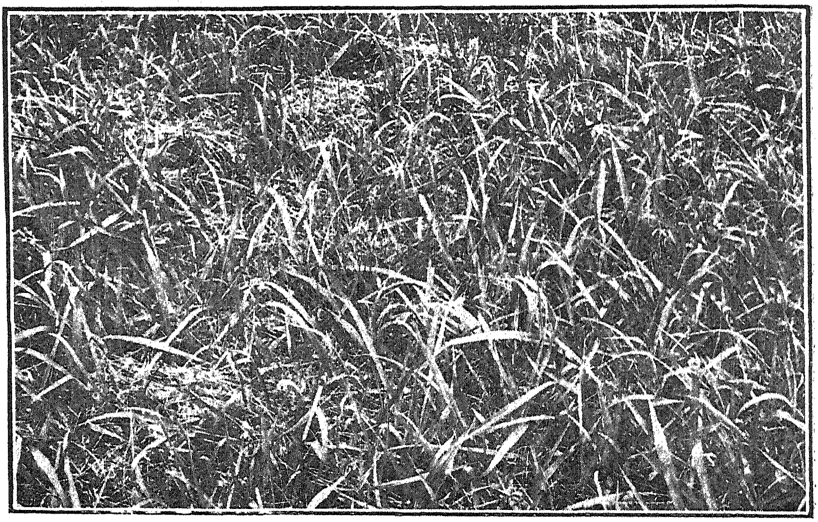

FIG. 92. PASPALUM AFTERMATH FROM HAY CROP HARVESTED IN DECEMBER.

From this area (a poor gum-land soil-type, North Auckland) a heavy crop of Lotus hispidus was taken off before Christmas, and the paspalum is now seen coming away to take up the running over the dormant period of this annual.

[*Photos by E. Bruce Levy.*

applied to the soil. Just as the dwindling and running-out of rye-grass, cocksfoot, &c., from the pasture is an indication of starvation conditions, so, too, the matting or sod-binding of paspalum indicates a shortage of the food-supply in the soil. In the case of paspalum pasture, perhaps the state is accentuated to some extent by the fact that when the sod-bound stage is reached the thatch-like cover formed by the turf over the soil precludes easy access of water and also of free air, thus preventing these natural ameliorating and recuperating influences from operating. The good effect from heavy tripod-harrowing or disking of sod-bound paspalum pastures is due largely to the aerating effect these processes have on the soil. In themselves, however, the disking or harrowing adds no additional plant-foods to the soil, but simply allows in air and water, which make available otherwise unavailable plant-foods locked up in the soil. This point will be treated a little more fully later on when dealing with permanent grasses for extremely poor soils.

Paspalum is not a suitable grass for poor soils. The fact that it is an extremely high producer under adequate feeding really rules it out as a suitable grass for poor soils, for the reason that a grass when starved is generally of very low palatability. This is no exception in the case of paspalum. Therefore, when dealing with poor soils, which owing to the topography and inaccessibility of the country are not capable of being improved in any way by top-dressing, &c., paspalum should not be sown. On poor soils, however, that can be top-dressed and the fertility built up, provided the climate is suitable, paspalum will return perhaps better than any grass, and the greater the improvement the greater will be the response—for paspalum is truly capable of responding almost to an unlimited degree.

In a sufficiently warm climate, then, where does paspalum come in as an important grassland constituent? Roughly speaking, the writer would say, from the brown-top standard of soil-fertility upwards. On the better class of brown-top country paspalum does quite well, but on the poorer brown-top country and on most danthonia country it is of little permanent value—unless, as before mentioned, top-dressing or other means can be adopted for building up the fertility.

On poor soils paspalum when establishing and spreading out—while it has room to tiller out and to occupy new ground—certainly does seem to be doing all right, beating easily on such soils any individual plants of brown-top or danthonia that it may be associated with (Fig. 93). But it must be borne in mind (as in the case of Poa pratensis, dealt with in the September issue of the *Journal*) that while there is room to tiller, fresh food reserves are being tapped by the outspreading plant. When the ground has been entirely covered by the plant, and when no fresh food reserves are left untapped, then is the sod-bound, low-production, thatched state reached, with a corresponding falling-off in carrying-capacity. It is the old mistake of putting a high producer on a soil that cannot support it permanently. A bankruptcy must surely follow, and the area will go out of business as a producer until such time as the farmer comes to the rescue with his plough or top-dressing, or else spells the area for some time to allow of natural recuperation by resting, fallowing, &c.

FIG. 93. PASPALUM-PLANT ON RIGHT SPREADING OUT ON POOR SOIL (GUM LANDS, NORTH AUCKLAND).

Paspalum is here established in a Danthonia semiannularis pasture. While the paspalum-plant can tiller out and occupy fresh ground it beats the Danthonia in production, but sod-bound pastures result on poor soils when all the ground is covered.

FIG. 94. PASPALUM AS A DOMINANT, NORTH AUCKLAND.

On all the moderately fertile soils of the North the farming of paspalum—full consideration being given to utilization and fertility-upkeep problems—is probably the most remunerative grassland farming in New Zealand.

[*Photos by E. Bruce Levy.*

CLIMATIC RANGE OF PASPALUM IN NEW ZEALAND.

Paspalum is one of the few grasses of economic importance so far introduced into New Zealand that are restricted in their spread by climatic conditions.

Paspalum is widely distributed in the North Auckland Land District, and bids fair to become a dominant over all the better-quality soils of that district (Fig. 94). South of Auckland it is more restricted, but each year is gaining in importance as far south as Te Kuiti (Figs. 95 and 96) and throughout the Waikato, Piako, Tauranga, Matamata, Whakatane, and Opotiki Counties. On the east coast as far south as Napier paspalum is of value (Fig. 90), and on the west coast as far south as New Plymouth, together with odd coastal localities even as far south as Foxton, this grass is well established and is inclined to spread. In the South Island paspalum also thrives quite well along the Sounds country from Picton to Nelson, and thence down the west coast as far south as Hokitika.

From this it will be seen that paspalum is becoming very widely distributed over the more temperate parts, and its range each year seems to be extended. In view of this fact it does seem imperative to have a clean-cut vision of the possibilities of paspalum on all types of country, and further work is needed along the lines of delineating the exact climatic range and the geographical boundaries within which this grass is of economic importance. In North Auckland, where it has now been established for approximately forty years, a very fair knowledge of paspalum can be attained. On the more fertile flats and on the better hill country many stands of paspalum from twenty to thirty years old are still producing well. In fact, wherever there is high soil-fertility no falling-off or sod-binding of paspalum takes place. Over much of that area, where repeated failure to secure permanent grassland by the sowing of the high-class English grasses has been met with, the use of paspalum has economically grassed many thousands of acres that would otherwise be rushes, niggerheads, toetoe, tall fescue, pennyroyal, buttercup, plantain, or other such weeds. Its inclusion also in the original bush-burn sowing has saved many thousands of acres of hill country from reverting to fern and other classes of secondary growth (Figs. 97 and 98). This is due largely to the fact that even where paspalum has fallen off considerably no opening-up of the paspalum turf has taken place, and hence little chance has been afforded secondary growth to become established. On the poorer hill country and on much of the gum lands of the North paspalum has done good work in the past, and will still do good work during the early years of production from these soils. Here, however, without attention being given to maintaining soil-fertility and to building it up as much as possible paspalum will produce well for ten to fifteen years, but will then, having occupied the whole ground-surface, fall off considerably in production and palatability, presenting then the matted, sod-bound state already referred to. The poorer the soil on which the paspalum is sown the sooner will the sod-bound stage—or one may more meaningly express it, the starvation stage—be reached. The writer has seen paspalum when thickly sown becoming sod-bound within three or four years. In fact, scarcely at any stage in such paddocks could one say paspalum was ever producing well, no room being afforded for any plants to become well established and to spread out to reach new zones of untapped plant-food supplies.

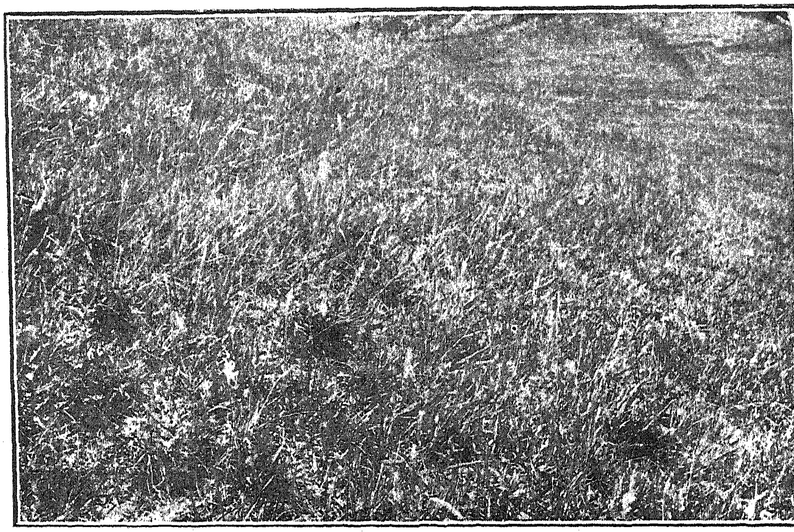

FIG. 95. PASPALUM ON HILL COUNTRY, TE KUITI, SOUTH AUCKLAND.

As far south as Te Kuiti paspalum will thrive quite well, and its longer dormant winter period in that situation can be easily overcome by top-dressing, which results in an increase of associate grasses and clovers. These not only throw feed during the dormant period, but through their shelter the paspalum is not so injured by frost, and hence it comes away quicker in the summer.

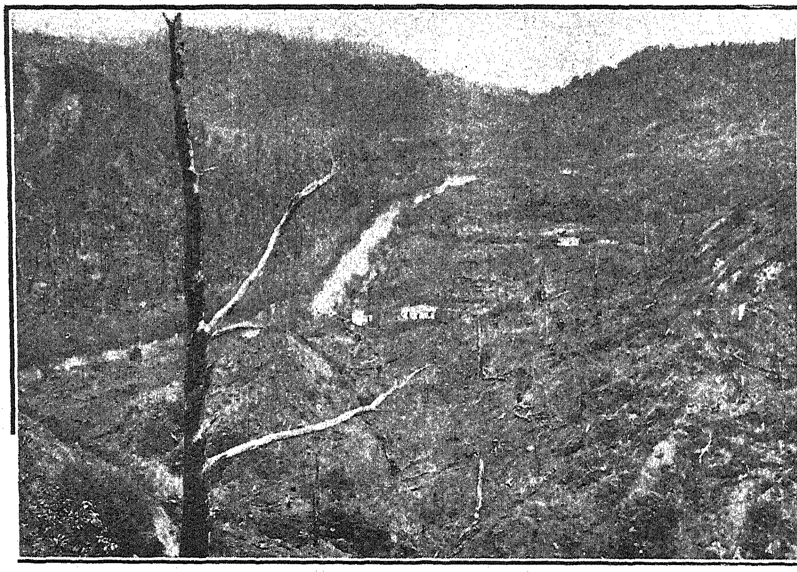

FIG. 96. TOWARDS THE SOUTHERN LIMIT OF PASPALUM—THE MOKAU RIVER.

On the flat (and richer portion) shown in the photo paspalum does quite well and is spreading naturally from seed. Its spread up the poor slopes, however, is not at all hopeful.

Photos by E. Bruce Levy.

FIG. 97. AREA—TO RIGHT OF FENCE—WHERE PASPALUM WAS INCLUDED IN THE ORIGINAL PRIMARY-BURN SEED-MIXTURE.

This area is now exceedingly well grassed, while on the left of fence, where no paspalum was sown, the land is a solid mass of bracken fern.

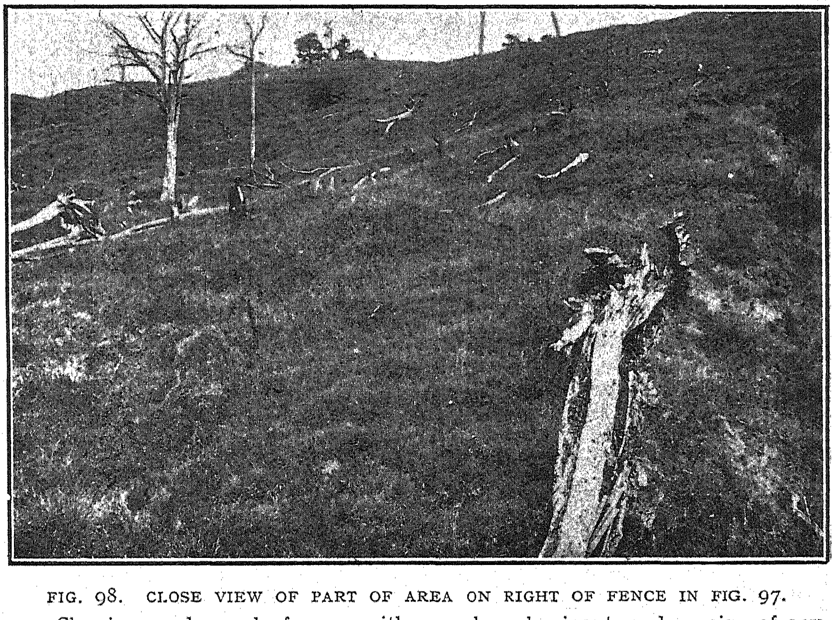

FIG. 98. CLOSE VIEW OF PART OF AREA ON RIGHT OF FENCE IN FIG. 97.

Showing good sward of grass, with paspalum dominant, and no sign of any secondary growth. [*Photos by E. Bruce Levy.*

This sod-bound state has been referred to as indicating starvation, the very binding-up of the turf accentuating the trouble by the more or less waterproof and airtight covering that the mat forms. The breaking of this cover or mat to allow free access of air and water, and the increase of soil-fertility by one means or another, are the two essentials to bring back sod-bound paspalum pastures to high production. On the ploughable country the breaking of the turf can be accomplished by the disk, heavy tripod harrows, or, better still, by ploughing the area in fairly narrow furrows, the furrows being set up to overlap one another at a fairly steep angle (Fig. 99). This ploughed area is left in the furrow until such time as fresh paspalum growth makes its appearance within the angle of the furrows. When the growth is a few inches high the area may then be disked and a seed-bed

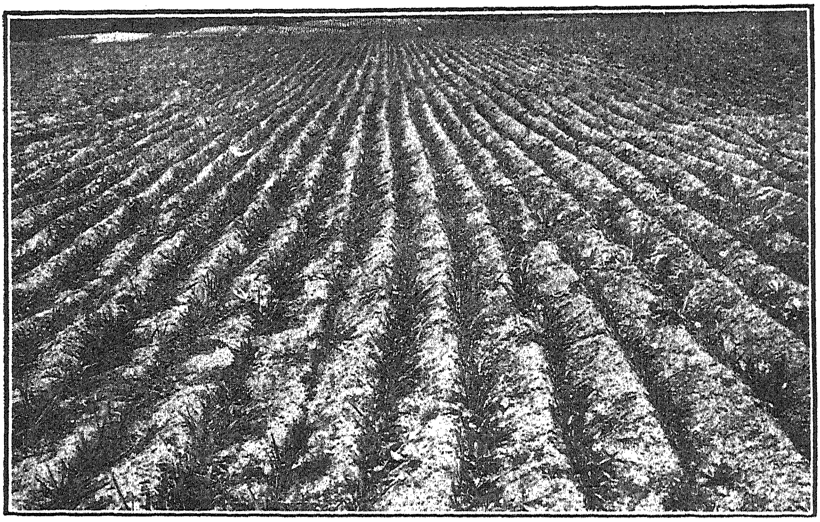

FIG. 99. RENOVATION OF SOD-BOUND PASPALUM PASTURE BY PLOUGHING.

The breaking of paspalum turf by plough, disk, &c., or by heavy treading by cattle, gives air and water easy access into the soil. Breaking the turf in this way and otherwise increasing soil-fertility are the two essentials to bring sod-bound paspalum pastures back to permanent high production.

[*Photo by E. Bruce Levy.*

prepared for roots, maize, or grass. The paspalum grows strongly along with such crops, and new vigour is put into the plant. This renovating operation, when analysed, is fulfilling the dual purpose mentioned for the satisfactory renovating of sod-bound turfs. By the ploughing, air and water are freely allowed into the soil, and by the turning-under of the turf an increase of fertility takes place, this turf soon rotting and providing quickly available plant-food for the few plants surviving along the edge of the furrow. This supply of plant-food, however, is not lasting, and after the second year, unless top-dressing is carried out, the paspalum takes on a starved appearance once more.

On steep hill country the foregoing methods of breaking the matted turf are not available, and the farmer must utilize to the best of his ability that all-important implement of hill-country management, the cattle beast. By the hoof cultivation possible through the use of this animal the turf may be broken, but the farmer must bear in mind that the actual breaking of the turf allows the entry of air and water only, and paspalum needs something more substantial than these if it is to get back to its former high production. Top-dressing with artificial manures is the most direct method of supply for this food deficiency. Feeding out hay or roots on to the area is also good where practicable, and this also provides keep for the cattle while working on the area to do the necessary poaching. Either hay or roots must be supplied, or else the area to be treated must be spelled for a full growing season so as to accumulate as much roughage as possible by winter-time, in which season this work of hoof cultivation is best performed, the ground then being sufficiently soft for the hoofs to break through the turf. This spelling and conversion of roughage by the full-grown cattle beast increase fertility to a small extent, and feeding out hay or roots gives added fertility increase, but the more direct and more lasting method is a good top-dressing of artificial manures. The point here that the writer wishes to make clear, however, is that paspalum can be brought back to high production from the sod-bound state once attention is given to the breaking of the turf by some implement or by cattle, and to bringing about in one way or another an increase of soil-fertility.

Prevention, of course, is better than cure, and one may feel sure that the farmer when he realizes why paspalum becomes sod-bound will make every effort to keep conditions right so that this high producer can function to its maximum capacity. Paspalum has by many been regarded as a foolproof grass—one that will fossick for itself ; one that does not need manure or care of any sort ; one to be condemned when it gets out of hand and rank on good country, and to be spurned when it becomes sod-bound on poor country. Paspalum has great potentialities within its climatic range, but it is not foolproof, and it demands for its proper care and management perhaps more skill on the part of the farmer than does any other single pasture or fodder plant that one could name—with perhaps the exception of lucerne. The writer knows of no grass, however, that will more repay the farmer the skill he puts into his grassland farming than will paspalum.

PASPALUM UNDER SHADY AND SECONDARY-GROWTH CONDITIONS.

Paspalum is an extremely good shade-endurer, and will persist strongly within fairly dense secondary growth—bracken fern, hard fern, short manuka, &c. (Fig. 100). It will penetrate into the heart of tussock growths such as rushes, niggerheads, toetoe (*Mariscus*), and tall fescue. Growing thus among these growths it serves as an excellent attraction to stock to work among the fern, &c., and firing the secondary growth does not in the least injure the crown of the paspalum. After the fire, particularly in an early summer burn, the renewed growth of the paspalum is extremely rapid (Fig. 101), and on fairly fertile soils quite a good cover is formed soon after.

Paspalum really fulfils the requirements necessary in a grassland species to economically and effectively deal with secondary growth

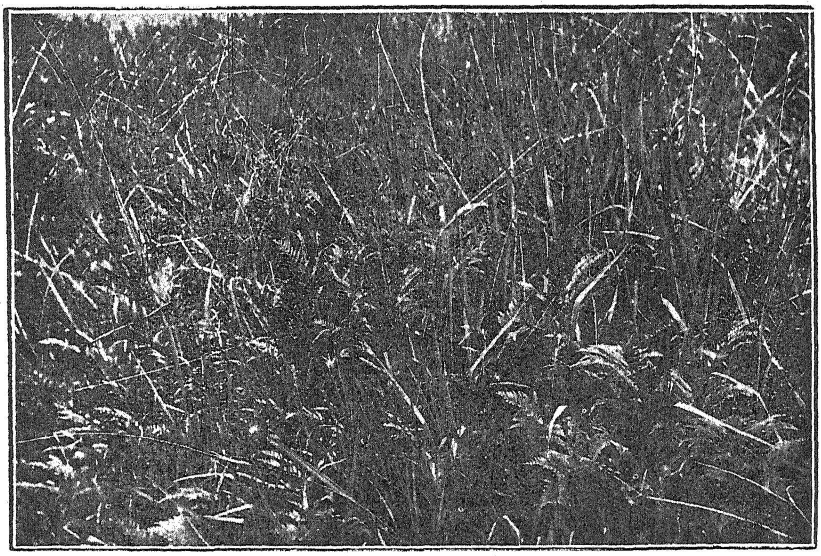

FIG. 100. PASPALUM COMPETING SUCCESSFULLY WITH HARD FERN, NORTH AUCKLAND.

Paspalum is here producing sufficient feed to induce stock to work on the area and crush out the fern growth.

FIG. 101. RENEWED PASPALUM GROWTH AFTER A SECONDARY-GROWTH BURN (GUM LANDS, NORTH AUCKLAND).

Paspalum withstands fire extremely well, and when once the plant is established among secondary growth no further seeding of the burn is necessary as far as paspalum is concerned. [*Photos by E. Bruce Levy.*

—that is, it will persist and thrive within shade of moderately tall secondary growth, thus serving as an inducement to stock to work on the area; it will carry a fire well without any injury whatsoever to itself; it comes away rapidly after a fire, and builds up rapidly to form a complete cover. Further, it is not necessary to buy further seed of paspalum once establishment on the area is effected, and thus the regrassing becomes decidedly economical, particularly where the secondary growth is of such a nature that it can be cleared off and destroyed by fire or cattle.

In this work of secondary-growth control, however, paspalum has limitations in two directions: (1) Its recovery after the fire is not rapid on poor soils, and (2) it is limited in its application by its fairly high temperature requirement. In North Auckland on all moderately fertile hill country paspalum has no equal as a controller of secondary growth. The writer has seen areas of bracken fern and hard fern completely controlled by paspalum (Figs. 102 and 103). On one farm in the Paparoa district this was accomplished by first establishing a small 5-acre paddock of paspalum on a ploughable piece of country in the heart of a bracken-fern area. When this paddock was firmly established, and while in full seed, the fence dividing the area from the rest of the fern country was removed and cattle put on. From the paspalum-paddock tracks radiating through the fern were first formed by the cattle using the fern block as a run-off, and along these tracks paspalum soon established itself from seed brought from the area by the cattle themselves. By the growth and spread of the paspalum along the tracks more cattle were worked on the area, and within five or six years most of the bracken fern was wiped out. Distribution of the paspalum-seed was also effected by surface-sowing by hand along the tracks and wherever there were open patches in the fern. These sowings were made at the rate of about 5 lb. of seed per acre of ground sown, and took place in the month of February.

Paspalum is of value not only for the control of bracken fern, hard fern, water-fern, manuka, tall fescue, &c., but also is most promising for the control of blackberry. Blackberry will not thrive with a tight turf of grass about its crown, nor can it spread by layering in a close turf such as paspalum can make. As far south in the Auckland District as Te Awamutu, on peat swamps, may be seen excellent examples of blackberry-control by the use of paspalum. In the east-coast district also, to as far south as Wairoa, the writer feels certain that on the better-quality soils at least, or where top-dressing can be systematically carried out, the establishment of paspalum among any blackberry that may be there is one of the means by which this troublesome secondary growth can be suppressed.

Again, in the case of piripiri a close turf-former like paspalum gives no facilities for the creeping stems of this weed to root and thus to form new plants (see Fig. 31 of this series, *Journal* for November, 1923). Piripiri when kept up off the ground is most susceptible to damage, particularly by grazing cattle. Keeping the creeping stem up off the ground by spelling or by the formation of a close turf and stocking with cattle are the basic principles underlying the control of this weed. Paspalum is a great turf-former, and therein lies its value as a weed-controller apart from the large bulk of feed it is capable of producing.

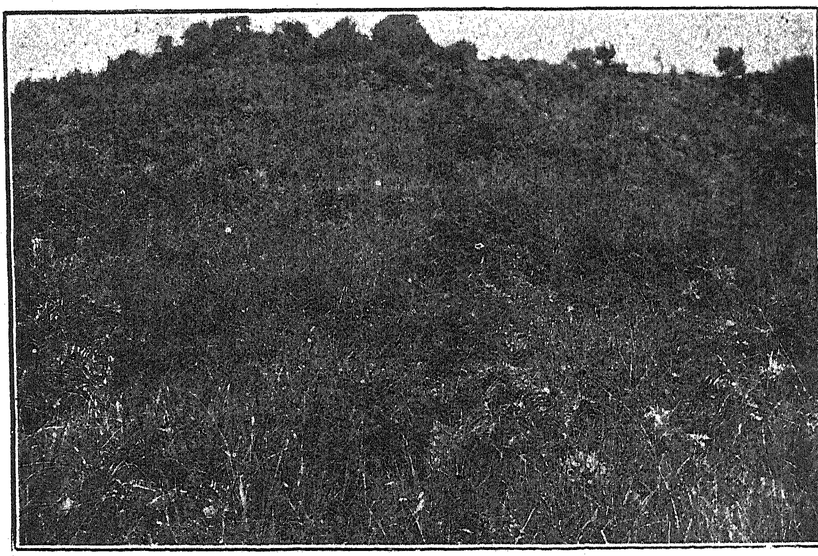

FIG. 102. HILLSIDE AT PAPAROA, NORTH AUCKLAND, WHERE PASPALUM IS GRADUALLY SPREADING INTO THE BRACKEN FERN AS THE LATTER IS CRUSHED BY CATTLE.

No burning was carried out in this case, but seed at the rate of 5 lb. per acre of the land sown was broadcasted along tracks and on the more open patches within the area.

FIG. 103. PASPALUM TURF ON SMALL, FAIRLY FERTILE AREA AT POHOKURA, SHOWING ITS CONTROL OF BRACKEN FERN.

Although this area of paspalum is not large, it gives quite a reliable indication of what paspalum will do on the more fertile and sunny slopes of the Taranaki back-country.

[*Photos by E. Bruce Levy.*

PASPALUM IN PRIMARY AND SECONDARY BURNS.

Paspalum is slow to establish from seed, two or three years often elapsing before much sign of the grass is seen when included in a mixture. Whether in the primary or secondary burn, therefore, this grass cannot be relied on to produce much feed for two years at least. Its growth from this period onwards is controlled largely by the fertility of the soil and the ruling temperature. It establishes quite readily in comparatively difficult places on the burn—on pukahu and other unconsolidated surfaces and on rather hard knolls—and although on these it does not produce much feed, yet it persists there and tends to cover the ground somewhat. In the third and fourth year of the burn paspalum comes in well as a follower on to the rye-grass, functioning in this respect in much the same way as does cocksfoot (Fig. 94). Its greater persistence and wide range of adaptability to varying conditions make it a better grass than cocksfoot on all country suitable for its satisfactory growth. From 2 lb. to 4 lb. of seed per acre is sufficient to include in the primary-burn mixture.

For the secondary-burn mixture within the paspalum climatic range the value of this grass largely depends on the quality of the soil. Paspalum is of such immense value for the control of secondary growth that no effort should be spared to make the soil conditions suitable. Its slowness to establish from seed certainly is a disadvantage, and this precludes ever making this grass a dominant in the mixtures sown. For the early stages of control of secondary growth after the burn some rapidly establishing grass is essential, otherwise the unchecked return of the secondary growth is so rapid that before the slow-germinating species have established from seed they are killed out by the shade formed by the secondary growth.

Paspalum is a good establisher on hard surfaces, being in this respect similar to crested dogstail. As before indicated, in North Auckland quite good establishment of paspalum has been effected by surface-sowing seed on weak grassland turf during the summer and early autumn (Fig. 104). Many farmers prefer spring-time for the sowing, but the writer is of the opinion that if paspalum fails to establish from early autumn sowings then the possibility of it doing well on that soil, even when established in the spring, is very remote. In sowings made in the Whangamomona district in 1924 on the sunny slopes paspalum germinated and came to the one-leaf stage within three weeks of sowing. These sowings were made about the middle of March. On shady slopes in that country up to the present no success has followed the sowing of paspalum. North of Auckland paspalum is usually successful on all aspects, but as far south as Te Kuiti and across to New Plymouth it would seem almost a waste of seed to include it in mixtures for shady slopes and colder aspects.

On very poor country, also, the writer does not recommend paspalum for secondary burns unless top-dressing is possible, and, bearing in mind the economics of top-dressing poor, hard country while there are any better-quality soils not top-dressed on the farm, it looks as though one must be content to leave the poorer and harder country for danthonia and similar low-fertility-demanding plants. The writer would again stress the necessity of recognizing that the high producer must be adequately fed if that plant is to produce a good-quality and highly palatable herbage, and to ensure permanent productivity from

the land on which it is sown. Paspalum is a high producer, and hence is a high-fertility-demanding grass, but owing to its growth-form it can retain possession of the ground to the exclusion of most other plants, even though its yield may fall off to a mere bite of highly unpalatable herbage.

With regard to the amount of seed to include in mixtures for secondary-growth burns, as before stated, paspalum is of no value as a feed-producer for the first or second year. Paspalum falls into a class of pasture plants that are expensive to establish and form a turf by the actual sowing of seed. In the Whangamomona sowings 8 lb. of paspalum was included in certain mixtures, but the feed produced from this heavy sowing has been very small indeed for the two years during which these sowings have been going, and compared with certain other grasses paspalum must be ruled quite out of reckoning so far as a cheap and rapid cover of the ground is concerned.

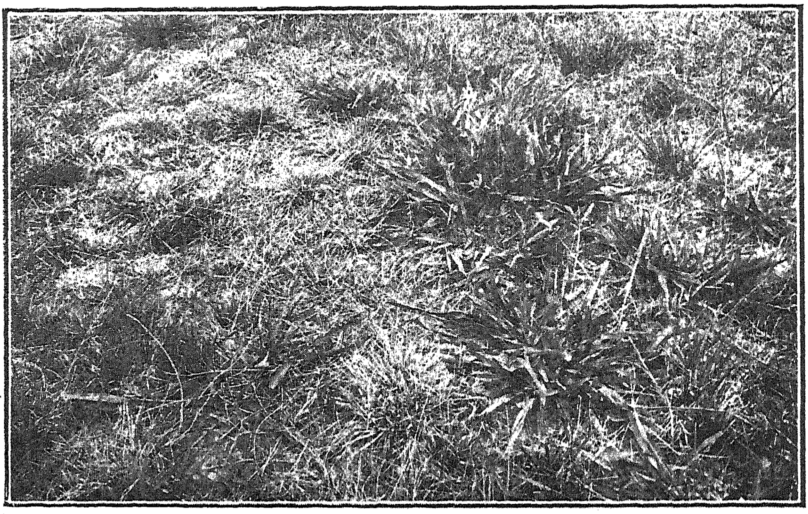

FIG. 104. PASPALUM ESTABLISHED FROM SEED SURFACE-SOWN ON WEAK TURF (NORTH AUCKLAND).

Even as far south as Whangamomona on the sunny slopes quite good results have been secured, as far as the establishment of paspalum is concerned, by surface-sowing this seed over weak, open turf.

[*Photo by E. Bruce Levy.*

Thus paspalum, along with certain other species, in order to be economically sound as compared with other cheap-establishing species, must have the capacity to spread out vegetatively from the few plants that are established, or else be able to propagate itself by reseeding. The writer is therefore inclined to sow only small quantities of paspalum in secondary-growth burns, and to rely entirely upon the ability of paspalum to spread vegetatively and by reseeding in later years. An amount of 2 lb. per acre for all secondary burns within the climatic range for paspalum is recommended. This small quantity of seed also gives other plants a chance to establish and to hold the ground on poor aspects, thus preventing the spread of paspalum on aspects where it is sure sooner or later to become sod-bound.

DISTEMPER OF DOGS.

CAUSE AND HOME TREATMENT OF THE DISEASE.

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As distemper has taken considerable toll of the dogs in some parts of New Zealand during the spring of this year, the following information regarding the disease may be of interest and assistance to farmers or others.

For some years past there have been two views held as to the cause of the disease. It is known to be an infection and highly contagious, but research aimed at discovering the actual causative agent was made very difficult by the fact that the disease is generally complicated by another superimposed trouble such as bronchitis, pneumonia, or inflammation of the bowels ; so that it was almost impossible to know what were the symptoms of distemper by itself or what course it would run if uncomplicated. There were two main opinions held. One was that the disease was due to a germ known as *Bacillus bronchisepticus canis*, the opinion being based on the fact that from a very high percentage of affected dogs this germ can be obtained, and, further, that symptoms like distemper have sometimes been produced by giving young dogs injections of this germ. The other view was that the *Bacillus bronchisepticus* was only a secondary invader, and that the real cause was what is known as a filter-passing virus. This is an agent which is too small to see with a microscope, but whose presence is known by the fact that fluids containing it can be passed through such fine filters that all visible bacteria are held back, and yet the fluid which comes through the filter is still capable of producing the disease in question if injected into a susceptible animal.

Of late years the latter view has become more and more established, till recently it has been placed on what appears to be an entirely firm foundation by the work of Dunkin and Laidlaw in England. A fund was raised by *The Field* in England some three years ago with the object of getting sufficient money to have the disease thoroughly investigated. Through this it has been possible to rear dogs in absolute isolation, and by so doing to know that the experimental animals are absolutely clean and free from all traces of distemper when experiments are made upon them, so that the real disease, shorn of its complications, has now been studied by the workers mentioned.

Although not the cause of the disease, *Bacillus bronchisepticus* is of considerable importance, owing to its being very widespread (often living harmlessly in the bronchial tubes of healthy dogs) and its ability to attack these tubes, and the lungs also, when the dog's system is weakened and its powers of resistance reduced, as they are during an attack of distemper. One of the features of the disease as it has recently affected dogs in this country has been the frequency of acute bronchitis and pneumonia, which were in all probability due to this secondary invader. It is only reasonable to suppose that if a healthy and susceptible dog comes in contact with another suffering from distemper and a complication he may contract not only distemper but

also the complication, and thus there is a tendency towards a series of cases all showing roughly the same picture.

As far as vaccination against distemper is concerned, there is really no such thing. Vaccines are used, but they are aimed at protecting the animal against the complications that may arise, and not against the actual disease. A dog that has once been attacked by the filter-passing virus of distemper and has recovered from it is immune from further attacks for the rest of its life, but no amount of vaccination with *Bacillus bronchisepticus* or other germs will protect a dog from distemper, though it may be beneficial in warding off dangerous complications.

In some cases nervous symptoms appear when the dog has been ill for two or three weeks. Such symptoms may take the form of a persistent twitching of the muscles or convulsions at more or less short intervals, or, again, the dog may roll over and over on its side persistently. The onset of nervous symptoms such as these is extremely serious, and very few dogs ever recover from them.

SYMPTOMS AND HOME TREATMENT.

Though adult dogs are not immune from attack, the disease is typically one of infancy—just as mumps and measles are in the human subject. Often an attack is so mild as to pass almost unnoticed, the dog merely being a little dull and off his feed for a day or two. The commonest symptom is a discharge from the eyes and nose, which, at first watery, soon becomes thicker and forms a dry yellow crust round the eyes and nostrils. Frequently also there is a slight throaty cough for a day or two. The temperature (normally about $101\frac{1}{2}°$ F.) rises sharply at the outset, then about the third day generally falls to nearly normal, and afterwards slowly rises again and may be elevated for some two or three weeks. This is an important point, since frequently a dog looks so much better after the first day or two that he is considered over the trouble, and no further attention is paid to him. Thus, when the temperature rises the second time, an exposure or an amount of fatigue which would do no harm to a healthy dog results in a relapse. It is then that complications such as pneumonia often set in and death frequently results.

As far as the home treatment of distemper is concerned, strict isolation from other dogs is, of course, the first consideration. Then, more can be done by sound and careful nursing than by using any of the patent medicines so often advertised. The disease is accompanied by fever in all cases, so that the patient must be kept warm, without, of course, cutting off the supply of good, fresh air. Absolute rest and freedom from excitement are highly necessary also, since the dog needs all his strength to fight the disease that has attacked him. The eyes and nostrils may be cleansed of discharge with boracic lotion. Diet should be light and easily digested, but nourishing and not too drastic a change from his accustomed food. A few days after the onset of symptoms diarrhœa generally occurs. The best course to pursue during this phase is to give a milk diet till it has ceased, and then gradually return to whole diet again.

Distemper is always to be regarded seriously, and veterinary aid should be obtained when possible, as the medicines necessary depend

entirely on the individual dog and the symptoms it shows. Warmth, rest, nourishing light diet, and good nursing are by far the best home treatment any case of distemper can have.

FERRETS AND DISTEMPER.

Dog-owners appear to be generally unaware of the fact that ferrets are attacked by distemper. Not only will the disease spread among ferrets, but also from ferrets to dogs, and *vice versa*. The symptoms in ferrets are high fever, discharge from the nostrils, and the formation of small blisters and pustules round the lips and mouth. Nerve symptoms occasionally occur, as in dogs, and the death-rate is very high. The importance of having these facts in mind, especially to the owners of rabbiting-dogs, is obvious, as also are the precautions indicated by them.

THE RELATION OF METEOROLOGY TO AGRICULTURE.

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LONG-TERM FORECASTS.

THE greatest service that the science of meteorology could render to agriculture would be the accurate forecasting of weather conditions for a fairly long period in advance. The value of such long-term forecasts can be appreciated, allowing as they would an adequate opportunity for the agriculturist to alter or adjust his routine to suit the approaching weather conditions. Were such a service feasible the economic gain to the agricultural community of this Dominion would be immense.

One realizes that, even with the existing short-term forecasts, great benefits would be obtained by agriculturists if more interest were taken and greater credence placed upon them. To-day meteorologists are in the position to render valuable assistance to farmers and collaborate with them with a view to obtaining better crops. The proper interpretation of prepared synoptic weather charts should make it possible to forecast the weather sufficiently early to enable possible injury to crops and stock to be greatly lessened. Although the day-to-day forecasts should apparently prove of value to New Zealand farmers, it has to be admitted that the shortness of the warning-period, coupled with the difficulty of obtaining prompt notice of weather-changes in the average country district, renders such forecasts of little practical value.

By long-time forecasts one does not necessarily infer predictions, say, one month ahead of the event. Such long predictions, of course, would be extremely desirable, but in an insular country such as this, with its paucity of outlying observation stations, they may be regarded as being quite out of the question. Forecasts giving four or five days' notice, widely and rapidly spread throughout the rural communities, and indicating on general broad lines the state of weather likely to be experienced, should be possible. The spread of radio broadcasting will doubtless assist in this respect.

SEASONAL CYCLES.

In rural New Zealand one hears in and out of season questions concerning the likelihood of a wet or dry summer, or a mild or severe winter. The farmer of to-day carries out his work in a more or less routine manner. He sows in the spring with the full expectation and general realization of spring rains, followed by mild weather during the early summer, merging into a general dry period of midsummer, and concluded by the approaching autumn and frosty winter. Unconsciously he postulates a more or less regular season, and hopes that his crop from the time of germination will grow steadily and uninterruptedly to a successful harvest. Thus far he is thoroughly conversant with a more or less definite weather cycle, and all his plans and preparations are made in relation to that cycle. In the majority of years his anticipations are realized and his crops grow favourably, but at other times a bad season or run of seasons is experienced, which greatly offsets the previous beneficial ones.

The anticipation of such seasons would undoubtedly be of great importance, and it should be the aim of the meteorologist to ascertain if a definite cycle of good and bad seasons exists in this country. At first sight it might appear impossible to make such an examination, on account of the comparatively short period of time over which meteorological observations have been made. An interesting attempt, however, was made by Douglas, who by an examination of the annual rings of the giant sequoias of California endeavoured to establish if a definite weather cycle existed in that country. It was naturally assumed that where the annual ring-growth was comparatively great a good season had resulted, and *vice versa*. Douglas examined 450 sequoias, ranging from seven hundred to two thousand years old. A correlation of growth with rainfall was recorded, this being greatest when a period of three years was taken with trees growing in dry situations, and with a period of ten years for trees in a wet situation. Already in New Zealand some preliminary work in this direction has been carried out by Dr. L. Cockayne, in connection with ecological problems, on the beech forests of Westland.

If sufficient statistics of the wheat-yields of Canterbury were available, these, correlated with existing rainfall records and other weather elements, might reveal some such cycle. The system hitherto generally adopted for making weather forecasts appears to have been essentially based on the statistical examination of meteorological data collected at various stations. It is interesting to note that many scientists have endeavoured to establish some connection between the variation in the frequency of sun-spots and the variations in certain terrestrial meteorological phenomena. It would appear essential, if an attempt is to be made in the distant future to correlate crop-yields with weather conditions with a view to investigating a probable cycle of seasons, that typical crop statistics should be taken in close proximity to each station from a few adjacent farms in order to reduce probable error.

CROP PREDICTIONS.

A wide scope lies before meteorologists in predicting the probable yields of different crops from a knowledge of the weather conditions

of the preceding autumn. Sir Napier Shaw in 1905 asserted that the average wheat-yield of England, in five seasons out of six, could be predicted with a certain degree of accuracy. When 39·5 bushels per acre was taken as the mean maximum yield, and a deduction of 1·25 bushels per acre made for each inch of rain which fell during the preceding autumn, a close approximation to the average wheat crop for the year could be obtained. It is interesting to speculate on the possibility of the meteorologist forecasting, say, the probable yield of turnips in Southland from a compilation of data in regard to frost intensity, rainfall, &c., having correlated such data with the optimum conditions for aphides, the organisms of club-root or dry-rot and other parasites of this crop.

There would appear to be no adequate reason why research on such lines should not be carried out, but it is opportune to here state that the services of a specialist in agriculture in addition to meteorology are essential. What would appear, therefore, to be necessary in New Zealand is an agricultural meteorologist. A meteorologist himself could not deal with the agricultural side of the question, neither could he cope with it from a botanical, biological, zoological, or chemical standpoint. Agricultural meteorology is a definite branch of agricultural science, but so far is unrecognized in this country. The agriculturist must indicate the direction the work has to take and point out the object aimed at. The meteorologist must use every means at his disposal to attain this object, and having apparently accomplished this the co-operation of both is essential in order to guarantee the correctness of conclusions arrived at.

AGRICULTURAL ZONES.

The agriculturist is concerned with the propagating of crops. His one aim is to understand the physiological conditions governing their growth, their reaction to environment, and their optimum growing factors. Many climatic factors, such as rainfall, sunshine, frost, &c., have a direct influence on the type of plant which may inhabit a particular locality. Thus we know that certain forms of vegetation will be prevalent in excessively wet districts, and that distinct vegetation will exist in arid districts. In other words, there are undoubtedly in New Zealand definite vegetation zones, which are more or less defined by climatic conditions. Just as vegetation zones exist, so do agricultural zones. Certain agricultural crops grow exceedingly well in the northern part of the Dominion but do not grow well in the south.

There may be wide zones or narrow zones according to the climatic adaptability of the plants under consideration, and it is here suggested that if sufficient meteorological data were obtainable from stations situated in suitable localities, definite agricultural zones would be formed by the correlation of climatic conditions with soil surveys and crop observations. Well-equipped stations under proper supervision should be established in suitable localities to afford such information. The distribution of stations of observation in New Zealand appears to be exceedingly unequal. The exposure of recording-instruments seems to follow no general rule, the instruments being sometimes placed at the top o: buildings and sometimes near the ground. There is an undue proportion of stations in the cities and towns, and these are subjected to whatever peculiar conditions exist there.

It would therefore appear that the meteorologist and agriculturist should formulate a chain of stations in desirable localities and in sufficient number to provide the necessary data for the solution of many agricultural problems. Wherever recording-stations are established absolute continuity of records should be aimed at, and frequent inspections of an advisory nature should be made of each station, with a view to remedying any defective instruments and more or less standardizing the methods of observation. To be of value observations must be exact, and if a high standard of efficiency in this respect is to be obtained the meteorological staff must periodically visit the observers.

Where for some reason the site of the station has to be altered, this should be done without any break occurring in the records, and the new site should certainly be in close proximity to the old one if the continuity of records over a long period is to be of value. Government experimental farms would appear to be ideal situations for well-equipped stations, on account of the staff available to carry out the recording-work, the value of such records in experimental farming, and the permanency of the farms themselves. The equipment of such stations and tabulating of data are of great importance, and it is intended herewith to deal with a few of the most important features in this connection.

RAINFALL.

The importance of rainfall upon the growth of plants is sufficiently great to warrant the careful study of this climatic factor. It is to be remembered, however, that since rainfall is so remote from being the immediate environmental condition controlling the water-supply to plants in nature the measurement of this climatic condition must not be regarded as being of great value in regard to plant activity or distribution. The rainfall records at present taken at the majority of stations are by means of an ordinary rain-gauge which collects any rain that may have been precipitated during the day. This method of recording rainfall loses much value from the fact that no indication is given in regard to the intensity of the fall. It would appear, therefore, that in so far as the research agriculturist is concerned greater value of records could be obtained by the installation of self-recording pluviometers. It seems, further, that a better interpretation of the possible effect of a recorded fall could be deduced by a study of the charts recording the rain which had been precipitated during the previous twenty-four hours. This would also eliminate the arbitrary period at present in vogue—namely, 9 a.m. on one day to 9 a.m. on the following day.

EVAPORATION.

Hand-in-hand with rainfall must be considered evaporation. This climatic factor appears to be neglected, but it is inconceivable to carry out a proper study of climatic factors in relation to agriculture without giving due consideration to the rate of evaporation existing in different districts. From a rainfall point of view one district may appear to be "wetter" than another. That is, there would apparently, from rainfall records, be more moisture in the soil for plants—postulating the same water-holding capacity for the soil in both localities. If, however, the relation of rainfall to evaporation is studied for any two districts under discussion it might readily happen that the so-called "wetter" district

was, from the point of view of vegetation, much drier on account of the greater rate of evaporation taking place there.

The rate of evaporation can quite easily and cheaply be recorded from a free surface of water, in a manner similar to that used at the Galloway Irrigation Farm in Central Otago. Unfortunately, there is no direct method of deducing the rate of evaporation of soil-moisture from the results of evaporation from a free surface of water; but, even so, the results of observations of the latter would be of immense help in aiming at conclusions as to the adaptability or otherwise of certain plants and fungi in different localities. Further, the study of the rate of transpiration by plants would be greatly facilitated, especially in those portions of New Zealand requiring irrigation.

It seems surprising that in New Zealand so little has been done in recording evaporation-rates. To obtain data bearing on atmospheric evaporating-power it is only necessary to operate a number of atmometers of the same kind in various climatic districts, being sure that all have similar local exposure. The importance of this condition to plant and animal life, and the relative ease with which it may be measured, warrants earnest consideration being given to the future recording of this climatic feature. Were such data available the ratio of precipitation to evaporation as an index to the external-moisture relation of plants could be ascertained.

WIND.

As a climatic condition that assuredly influences the rate of transpiration from plants and of soil evaporation, and, further, from its often undesirable effect on live-stock and highly specialized crops such as fruit, average wind-velocity, with maximum velocity and duration and also directional origin, should be recorded. Ecologists as well as agriculturists would welcome reliable information in this regard.

SOLAR RADIATION.

The importance of recording hours of sunshine and intensity need not be stressed. It is to be emphasized that the few sunshine-recorders now in this country give but little information as to the intensity of the sunshine itself. They record the duration aspect of that range of intensities which is called direct sunshine, and any data which have been thus collected are consequently of limited value. The intensity of impinging radiation should be recorded, and a systematic attempt to carry out such recording should be put in hand. Beyond a certain intensity sunshine may have a negative effect upon vegetable growth, in that it induces closing of the stomata and partially suspends transpiration and respiration. Probably Livingstone's radio-atmometer may prove to be the most convenient instrument for carrying out records of this nature.

TEMPERATURE.

Data of maximum and minimum temperatures are of great value in deducing the frost-free period of the year, which is of the greatest importance to agriculturists. The frost-free periods of different districts, provided sufficient recording-stations were available, would be most valuable. The average dates of occurrence of the last frost in spring and the first in autumn would furnish a valuable index to

the approximate length of a temperature season of general plant-activity.

The absolute temperature maxima and minima are also valuable as intensity-indices. More information, however, is desirable in regard to (1) the length of the period of high daily normals, and (2) the length of the period of low daily normals. The value of the present available information from the 9 a.m. maximum and minimum temperatures lies in the fact that one can record with a certain degree of accuracy the accumulated temperature in hour-degrees above a chosen datum-line, thus indicating the probable value of such degrees to plant-development. Taking 68° F. as the critical normal daily mean temperature, and 32° F. also as the critical normal daily mean, one would naturally value information from an adequate number of stations in New Zealand of the length of period with normal daily mean temperature of 68° F. or above, and of the length of period with similar means of 32° F. or below, within the year.

Soil-temperatures would also be of value, but the recording of such may be regarded as impracticable on account of the difficulty of establishing a unit of measurement in view of the variation induced by the nature of the soil itself and its situation.

AIR-HUMIDITY.

The usual method of obtaining data in regard to relative air-humidity in New Zealand is by the wet- and dry-bulb thermometers. Relative air-humidity, however, is no direct indication of the absolute amount of moisture in the air, and it is the latter information that is required by agriculturists. Consideration should be given to the fact that as the temperature is lowered the capacity of the air to retain moisture is decreased; and hence it follows, where two stations record the same average percentage of relative humidity but different mean temperatures, that station having the higher mean temperature will have the greater amount of moisture. Air-humidity is of great importance to the farmer. It not only affects the rate of transpiration from plants, but is a deciding factor in the prevalence or otherwise of various parasitic fungi affecting crops. Certain districts in New Zealand are practically free from certain plant-diseases, and it is probably not far from the mark to infer that the relatively low humidity of the air in those districts accounts for such freedom. Mycologists would welcome fuller records of not only the relative humidity of different districts, but also the average humidity of the day.

CONCLUSION.

In conclusion, the following thoughtful statement of Livingstone and Shove ("The Distribution of Vegetation in the United States as related to Climatic Conditions") may be quoted: "Climatological methods and climatological interpretations, as so far developed, are woefully inadequate for the solution of problems dealing with the control of plant-distribution. From the standpoint of ecology and agriculture no great progress is to be expected until much more attention is given to the devising of new methods for obtaining the climatic records and new methods of interpreting these records, and until a new point of view is reached different in many respects from that hitherto held by workers in climatology."

FRUIT VARIETIES FOR EXPORT AND LOCAL MARKETS.

REPORT OF THE 1926 DOMINION CONFERENCE.

J. A. CAMPBELL, Director of the Horticulture Division (Chairman).

THE third Dominion Fruit Varieties Conference was held at the Dominion Farmers' Institute, Wellington, on Friday, 20th August, 1926. Delegates representing fruitgrowers, the Nurserymen's Association, the Institute of Horticulture, the Fruitgrowers' Federation, and the Department of Agriculture were present.

The conference considered and—with the exception of apples and pears for export—adopted the varieties with respect to the different classes of fruit recommended by the provincial conferences previously held to consider the matter. The whole is set out in the subjoined lists.

The conference wishes it to be clearly understood that in view of the fact that at the present time the production of apples and pears is, under existing means of distribution, much in excess of local requirements, and that the position would be further involved should any curtailment of our export trade occur, anything in the nature of extensive planting of these fruits would, in its opinion, be altogether unwise until such time as our export trade shows unmistakable signs of having been established on a sound and payable basis. On the other hand, it is of the opinion that the prospects warrant a reasonable extension of our stone-fruit areas in those districts suited by climate and situation for the purpose. However, if planting in any branch is decided upon, the lists, taken in conjunction with local experience, should enable a suitable selection to be made.

The conference strongly supports the recommendation made by previous conferences for the elimination as rapidly as possible of unsuitable and unpopular export varieties of apples by reworking with one or another of the varieties recommended, thereby reducing the varieties now being exported to a reasonable number. This excessive number of varieties is the weakest spot in our present export practice. Referring thereto the Imperial Economic Committee, in its Third Report, after speaking very highly of New Zealand export practices, on page 92 states: "We would mention that in 1924 South Australia alone shipped no less than fifty-six separate varieties, and New Zealand nearly fifty distinct varieties, to the United Kingdom market . . . and we recommend that producers should take steps to ascertain the most suitable varieties for staple production, to the number of perhaps not more than ten or fifteen, and concentrate on growing these, at the same time taking energetic measures to eliminate unsuitable sorts."

The position last season became worse as far as New Zealand was concerned, for fifty-nine varieties were exported. As already suggested, steps should be taken to remedy this evil as early as possible.

Apples.

NOTES ON VARIETIES RETAINED OR DELETED.

Gravenstein.—This variety has been retained on the list. It is grown to a considerable extent in the Auckland Province and to a lesser degree elsewhere. Although not the best of carriers, its season makes it highly suitable for early shipments, and when properly handled and shipped it should reach the London market in good condition. The strain of Gravenstein, however, recommended by the Committee is that known as Albany Beauty, and nurserymen will be requested to raise this strain under the name of Gravenstein; also, when working over is being done growers are advised to use the Albany Beauty strain.

Golden Pippin has been deleted from the export list, having failed to meet expectations in this connection.

Willie Sharp.—This variety has been substituted for Golden Pippin. In colour the apple is green and golden. The tree is easily grown, and is a consistent bearer, and although not a high-priced apple locally, being early it is suitable for building up early shipments. But the main reason for its inclusion is that it is the best commercial apple of the early season which is at the same time suitable for fertilizing Delicious.

Scarlet and Worcester Pearmain.—Both these varieties have been deleted. They were originally included on account of their colour and early season, but experience has shown that they carry badly, and even when landed on oversea markets in good order frequently fail to bring satisfactory prices.

Cox's Orange, Jonathan, Delicious, Dunn's Favourite, Statesman, and *Sturmer,* having proved themselves to be highly suitable varieties for export in their respective seasons, have been retained.

Cleopatra.—This variety is a great favourite on the English market. Its great fault, however, is hollow or mouldy core. It does better in some districts than in others, and has been retained on the list in the interests of those districts where it does well.

Rome Beauty has proved itself to be a suitable apple for export, and although—like Cleopatra—it is better in some districts than others, it has therefore been retained on the list in the interests of those districts in which it does well.

Brighton.—This is a highly coloured apple. It does well in some parts and should be tried in other districts. It has been added to the list in the interests of Auckland as a substitute for Sturmer, the latter not having proved satisfactory in all parts of the Auckland Province. Grown under certain conditions this variety is said to be subject to Jonathan spot, consequently it would be unwise to plant it largely in any district until after it has been tested.

Tasma.—This is another highly coloured variety, and has proved very satisfactory for export, particularly as grown in the Nelson District. This variety has possibilities. It is said not to succeed in all districts. The Committee therefore recommends that it be generally tested with a view to determining the districts for which it is suited.

Newtown Pippin has proved itself to be a highly suitable variety for export when properly grown, but it is not grown to perfection in all parts of New Zealand. It has been added to the list mainly in the interests of Otago.

Glengyle Red is a highly coloured apple that is worthy of wider attention. It has not yet been fully proved in all districts, but succeeds well in some, notably Canterbury.

Granny Smith.—This is rather a surprising apple, green to yellow in colour, a good cooker, and very fair dessert; but, notwithstanding its appearance, it so far commands a high price on almost all markets on which it has been placed. It is an excellent carrier, but rather on the late side for heavy production for export. However, there should be room for a reasonable production of the variety.

DOMINION LIST OF EXPORT APPLES.

Gravenstein.	Delicious.	Sturmer.
Willie Sharp.	Cleopatra.	Brighton.
Cox's Orange.	Rome Beauty.	Granny Smith.
Dunn's.	Glengyle Red.	Tasma.
Jonathan.	Statesman.	Newtown Pippin.

The representatives of the various districts selected from the Dominion list of varieties recommended for export those varieties best suited for their particular district, as follows:—

Auckland.

Gravenstein.	Dunn's.	Rome Beauty.
Willie Sharp.	Jonathan.	Brighton.
Cox's Orange.	Delicious.	Granny Smith.

Hawke's Bay.

Cox's Orange.	Jonathan.	Delicious.
Dunn's.	Statesman.	Sturmer.

Wairarapa and Wellington.

Cox's Orange.	Jonathan.	Sturmer.
Dunn's.	Delicious.	

Canterbury.

Cox's Orange.	Jonathan.	Glengyle Red.
Dunn's.	Delicious.	Sturmer.

Nelson.

Cox's Orange.	Delicious.	Sturmer.
Dunn's.	Statesman.	Tasma.
Jonathan.		

Otago.

Gravenstein.	Cleopatra.	Sturmer.
Cox's Orange.	Delicious.	Tasma.
Dunn's.	Rome Beauty.	Newtown Pippin.
Jonathan.	Statesman.	

DOMINION LIST OF APPLES FOR LOCAL MARKET.

For the local market the following varieties are recommended in addition to those on the export list:—

Gladstone.	Lord Suffield.	Lord Wolseley.
Beauty of Bath.	Alfriston.	Ballarat.
Red Astrachan.		

VARIETIES OF APPLES FOR FURTHER OBSERVATION.

Varieties of apples placed by the Varieties Conference of 1920 on a list for further consideration were considered. *Glengyle Red* was highly spoken of by Canterbury growers, and by their request is placed on the export list, while in other districts it is to receive further testing. *Granny Smith* received strong support, and was passed for both the export and local market lists. *Brighton* was highly approved by the Auckland delegates and placed on the export list. *Tasma* received similar approval from Nelson growers, and was also added to that list. By unanimous approval *King David, Marian Red, New Gold Pearmain, Premier, Parlin's Beauty, Ranelagh, Rival, Shepherd's Perfection,* and *Giant Jenneton* were struck off the lists.

The following varieties were considered by conference to be worthy of further observation in the different fruitgrowing districts with the view of including them in the list of apples recommended for planting :—

Celo.	Late Market.
Ballarat (Moteo sport).	Salome.
Delicious (Gisborne sport).	Becroft (new strain of Dunn's).
Jonathan (Ettrick sport).	Bonum.
Golden Delicious.	Reinier.
Stayman's Winesap.	McIntosh Red.
McMahon's White.	Seedling No. 16.
Shoreland Queen.	Homing.
Cox's Orange × Delicious Seedling.	

Pears.

DOMINION LIST OF VARIETIES.

Where the planting of pears is decided upon, the selection should be confined mainly to the later keeping varieties, selected to suit the locality, from the following :—

Beurré Bosc.	Winter Cole.	Broompark.
Packham's Triumph.	Josephine de Malines.	L'Inconnue.
Twyford Monarch.	Winter Nélis.	

Where canning facilities are available the following varieties may be planted :—

Williams Bon Chrétien.	Keiffer's Hybrid.

If a rotation of pears is desired, a selection made from this list should prove satisfactory :—

Clapp's Favourite.	Conference.	Winter Nélis.
Williams Bon Chrétien.	Beurré Diel.	P. Barry.
Louise Bonne of Jersey.	Doyenné du Comice.	Broompark.
Beurré Bosc.	Winter Cole.	Twyford Monarch.
Packham's Triumph.	Josephine de Malines.	L'Inconnue.

Stone-fruits.

The local conditions in the different fruitgrowing districts are so varied that district lists only are given of kinds and varieties of stone-fruits recommended for planting. The lists are very long, but as each variety is available only for a short period it is considered necessary to plant a number of suitable varieties to obtain a succession covering the whole season.

Key letters printed with the different varieties denote the following :—

A, Auckland.
H, Hawke's Bay.
N, Nelson.
M, Motueka.
C, Canterbury.
O, Otago.

In addition the following letters are employed to describe the kinds of peaches :—

D, Dessert.
Y, Yellow flesh.
SCl, Semi-clingstone.
C, Canning.
F, Freestone.
W, White flesh.
Cl, Clingstone.

PEACHES.

OH	Le Vainqueur ..	DWSCl.
OCMNH	Mayflower ..	DWSCl.
O	Sneed ..	DWSCl.
O	Alexander's Early ..	DWSCl.
OCMN	Briggs' Red May	DWSCl.
OH	Sanders ..	DWSCl.
H	Husted ..	DWF.
H	Eulatus ..	DWF.
OH	High's Early Canada ..	DWSCl.
ON	Triumph ..	DCYSCl.
OM	Hale's Early ..	DWSCl.
OCMNHA	Wiggins ..	DWSCl.
A	Mamie Ross ..	DWSCl.
OHA	Peregrine ..	DWSCl.
OHA	Carman ..	DCWF.
ONA	Kia Ora ..	DCYF.
A	Stark ..	DWF.
A	A1	DCYCl.
MNH	Elberta ..	CYF
NCOM	Royal George ..	DWF.
H	Osprey Improved	DWF.
O	Delicious ..	DYF.
O	Muir	DCYF.
H	American Pound	DWF.
H	Prince of Wales	DWSCl.
H	Mary's Choice ..	DYF.
OMNH	Kalamazoo ..	DCYF.
ON	Lady Palmerston	DCYF.
OCMHA	Golden Queen ..	DCYCl.
N	Sea Eagle ..	DCYF.
OA	J. H. Hale ..	DCYF.
N	Golden Eagle ..	DCYF.
OHA	Paragon ..	DCYCl.
ONH	Gold Dust ..	DCYCl.
HA	Wheatland ..	DCYF.
H	Late Crawford ..	DYF.
OCHA	Salway ..	CYF.
HA	Lippiatt's Late Red ..	DWCl.
M	Pullar's Cling ..	CYCl.

NECTARINES.

OA	Ansenne.
CMH	Early Rivers.
N	New Boy.
OCMNHA	Goldmine.
H	Victoria.

PLUMS (ENGLISH).

C	American Early.
OCMNH	Evans' Early.
OMNH	Early Rivers.
C	Rivers' Early Prolific.
OC	Early Orleans.
OCNH	Angelina Burdett.
OCH	Greengage.
M	Reine Claude de Bavay.
OCH	Kirk's.
ONH	Pond's Seedling.
OCH	Coe's Golden Drop.
OCMNH	Diamond.
OCH	Magnum Bonum (yellow).
ONH	Jefferson.
ONH	Monarch.
O	President.
OCNH	Grand Duke.

PLUMS (JAPANESE).

N	Hermisillo.
HA	Sharp's Early.
OCNHA	Wright's Early.
OCMNHA	Burbank.
A	Doris.
ONA	Satsuma.
HA	Sultan.
A	Wickson.
HA	Purple King.
MNHA	October Purple.
N	Doris.

PRUNES.

A	Fellenberg.	A	Petite d'Agen.
A	Golden Prune.	OHA	Tragedy.
ONH	Giant.	O	Silver Prune.

APRICOTS.

OCNA	Newcastle.	OA	Boulton.
OCA	Oullin's Early.	OA	Hemskirk.
OCNA	Roxburgh Large Red.	OA	Royal Late.
OCNA	Moorpark.	CA	Mansfield's Seedling.

CHERRIES.

OCMNH	Early Purple Guigne.	C	Black Republican.
OCMN	Werder's Early Black.	C	Chapman.
OH	Early Lyons.	C	Doncaster Prolific.
OCMNH	Early Rivers.	H	Bigarreau Jaboulay.
O	Knight's Early Black.	OCMH	Bedford Prolific.
CN	Black Heart.	O	Centennial.
OCMNH	Black Tartarian.	OMH	Florence.
OCMNH	Bigarreau Napoleon.	OH	Black Eagle.
O	May Duke.	OCMNH	St. Margaret.
H	White Heart.	O	Black St. Margaret (Australian).
C	White Elton.		
C	Bigarreau.	O	Bing.

STONE-FRUITS FOR FURTHER OBSERVATION IN THE VARIOUS DISTRICTS.

The following list was drawn up for this purpose :—

Auckland.—Plums (Japanese) : Dreadnought, Billington's Seedling.

Hawke's Bay.—Canning peaches : Tuscan, Phillips, Sims, Pullar's.

Otago.—Peaches : Royal Charlotte, Husted's Early, Osprey Improved.

Nectarines : Lily Baltet, Grand Admiral, Victoria.

Plums (English) : Reine Claude de Bavay, Washington, Victoria.

Plums (Japanese) : Doris, Santa Rosa, Bellena, Hermosilla, Maynard.

Prunes : Splendour, Goliath, Hungarian.

Apricots : Large Early, Late Warwick, Harris, Sunrise, Riverside, Tilton.

Cherries : Frubeste der Mark, Chapman, Belle Ellen, Claremount, Gean d'Annonay, Noble.

Citrus-fruits.

The Committee appointed by conference to deal with citrus-fruits reported as shown in the following lists :—

	Varieties recommended for Planting.	Varieties recommended for Further Trial.
Lemons	Lisbon, Eureka.	Genoa, Meyer.
Limes	Tahiti.	
Oranges (sweet) ..	Navelencia, Valencia Late.	Best's Seedless, Gold Nugget, Navel.
Oranges (preserving) ..	Poorman.	..
Pomelos	March Seedless.	Foster, Sampson Tangelo.
Mandarins	Scarlet, Thorny.	Dancy's, Ellendale Beauty.

AGRICULTURAL SEEDS.

NOTES AND FIGURES ON VARIOUS ASPECTS.

NELSON R. FOY, Seed Analyst, Biological Laboratory, Wellington.

THE information pertaining to farm seeds contained in the following notes has been prepared in response to various inquiries from readers of the *Journal*, and should be useful for reference purposes.

NUMBER OF SEEDS PER POUND WEIGHT.

This figure naturally varies as between different samples of the same kind of seed. Particulars of the various species presented in Table 1 are averages of a considerable number of estimations made at this Laboratory.

Table 1.—Showing Average Germination, Number of Seeds per Pound, and Number of Viable Seeds in 1 lb. of Average Seed.

Seed.	Average Germination.	Number of Seeds per Pound.	Number of Viable Seeds per Pound.
	Per Cent.		
Perennial rye-grass	85	243,500	207,000
Italian rye-grass	85	229,000	195,000
Western Wolths rye-grass	85	225,000	192,000
Timothy	90	1,160,000	1,000,000
Cocksfoot	65	510,000	332,000
Meadow-fescue	75	252,500	189,000
Chewings fescue	90	487,500	439,000
Crested dogstail	90	820,500	738,000
Meadow-foxtail	30	540,000	162,000
Red-top	90	5,250,000	4,725,000
Brown-top	80	5,500,000	4,400,000
Poa pratensis	55	2,265,000	1,249,000
Prairie-grass	60	38,000	22,800
Danthonia pilosa	50	560,000	280,000
Danthonia semiannularis	50	880,000	440,000
Paspalum	40	454,000	181,600
Red clover	90	240,000	216,000
White clover	90	670,000	603,000
Alsike	90	650,000	585,000
Suckling-clover	90	1,000,000	900,000
English trefoil	90	305,000	274,500
Lotus hispidus	80	930,000	744,000
Lotus major	80	925,000	736,000
Lucerne	90	240,000	216,000

LONGEVITY OF SEEDS.

The period for which seeds retain vitality varies considerably, both as regards the different species and within an individual species. Retention of viability is dependent upon so many factors—such as degree of maturity when harvested, humidity at harvest, and humidity and temperature during storage—that it is difficult to lay down any definite period. Table 2 has been compiled from a series of tests carried out at this Laboratory on a number of average commercial samples, and

shows the average growth at intervals from August, 1924, to September, 1926. All the seed was harvested in 1924, and is, therefore, nearly three years old.

The figures given in Table 3 are taken from tables published by K. Dorph Petersen, Director of the Danish Seed-testing Station, and

Table 2.—Showing Rate of Decline in Germination of Main Grass and Clover Seeds.

Seed.	Aug., 1924.	Oct., 1924.	Feb., 1925.	June, 1925.	Sept., 1925.	Feb., 1926.	June, 1926.	Sept., 1926.
White clover ..	98	99	96	97	98	98	98	98
Cow-grass	98	95	99	98	99	99	90	92
Lucerne	96	96	97	96	95	94	94	76
Lotus major	95	92	90	91	90	90	90	96
Perennial rye-grass (1)	92	90	90	86	81	76	77	68
Perennial rye-grass (2)	98	98	96	92	89	86	83	75
Perennial rye-grass (3)	99	98	98	96	94	95	98	96
Perennial rye-grass (4)	92	90	89	87	86	86	81	84
Italian rye-grass ..	94	95	91	92	93	90	84	88
Brown-top	78	75	74	72	74	75	79	72
Crested dogstail (1) ..	97	96	97	89	77	70	70	61
Crested dogstail (2) ..	92	92	90	76	38	19	19	0
Chewings fescue ..	92	90	74	62	30	1	0	0
Danthonia pilosa ..	40	37	17	12	11	5	4	11
Cocksfoot (1) ..	65	57	51	51	49	50	48	37
Cocksfoot (2) ..	70	67	70	69	64	60	61	44
Paspalum	62	58	61	56	49	48	51	52

Table 3.—Showing Decline in Germination over a Period of Years: Tests made at Danish Seed-control Station, Copenhagen, under Continental System.

The figures preceded by the plus sign (+) in the clovers, &c., refer to the percentage of hard seeds.

Seed.	One Year.	Two Years.	Three Years.	Four Years.	Five Years.	Ten Years.	Fifteen Years.	Twenty Years.
Red clover	97+ 3	99+ 1	97+ 3	86+ 5	48+ 4	0+ 3	..	..
White clover.. ..	83+15	77+33	80+10	79+12	61+16	8+10	7+6	0+10
Alsike	83+16	81+18	83+15	77+19	53+17	1+14	7+6	1+ 7
Lucerne	91+ 8	88+ 7	93+ 3	84+ 3	79+ 3	34+ 4	4+0	..
Crimson clover ..	98+ 0	95+ 1	90+ 0	41+ 0	1+ 0	..	..	..
Lotus corniculatus ..	75+18	81+14	73+13	67+ 9	40+11	1+12	0+8	0+10
Timothy	98	95	91	79	53	..	..	..
Perennial rye-grass ..	92	89	89	87	67	..	..	..
Italian rye-grass ..	83	79	79	65	57	2	..	..
Meadow-fescue ..	98	94	96	81	42	..	..	..
Sheep's fescue ..	89	84	76	54	14	..	..	..
Cocksfoot	90	85	88	88	77	1	..	..
Meadow-foxtail ..	89	84	66	56	30	..	..	..
Agrostis sp.	91	96	93	92	92	32	..	..
Poa pratensis ..	78	94	87	85	72	1	..	..
Crested dogstail ..	63	53	33	13	5	..	..	..
Oats	84	71	81	75	59	32	..	..
Barley	100	100	97	90	42	5	..	..
Wheat	92	95	87	88	74	..	..	..
Mangold	84	90	88	86	92	53	1	..
Turnip	98	97	98	95	98	66	..	..
Carrot	77	69	65	53	39	..	..	..
Peas	87	..	90	94	90	47	..	..

serve to show the decline in germination over a period of years. It should be remembered that these percentages refer to actual samples, and are not to be taken as standard for each species; also that the percentages refer to the total germination, and that while this may be reasonably high the vitality of the seed as shown by speed of growth will have decreased to a much greater extent. Summarizing the two tables (Nos. 1 and 2), it can be taken that with one or two exceptions seed for sowing purposes should not be kept longer than two years after purchase, at which time the seed will probably be about three years old.

GERMINATION.

The average germination of the different species varies considerably —what is high for one may be low for another. The average germination percentages for this country are shown in Table 1. Approximate grading according to germination is presented in Table 4.

Table 4.—Grading according to Germination.

Grade 1: First-class commercial seed. Grade 2: Average quality. Grade 3: Below average quality. Grade 4: Seed of little value.

Seed.	Grade 1.	Grade 2.	Grade 3.	Grade 4.
Cocksfoot—Danish	85–100	65–84	40–64	Below 40
Cocksfoot—Akaroa	75–100	60–74	40–59	40
Rye-grass	90–100	80–89	50–79	50
Crested dogstail	90–100	80–89	50–79	50
Chewings fescue	90–100	80–89	50–79	50
Meadow-fescue	85–100	75–84	50–74	50
Brown-top	85–100	70–84	50–69	50
Danthonia	60–100	35–59	25–34	25
Timothy	90–100	80–89	60–79	60
Poa pratensis	75–100	60–74	45–59	45
Paspalum	60–100	35–59	25–34	25
Meadow-foxtail	50–100	30–49	20–29	20
White clover and alsike, Cow-grass, Lucerne	95–100	85–94	70–84	70
Lotus sp.	85–100	70–84	50–69	50
Swede and turnip	90–100	80–89	70–79	70
Mangold	80–100	65–79	50–64	50

MOISTURE CONTENT.

The ability of seed to retain vitality is intimately associated with the water content. The drier the seed the longer will vitality be held, and *vice versa*. Consequently seeds held over from one season to another should be stored under the driest conditions obtainable.

The average moisture content of grass-seeds ranges from 10 to 15 per cent.; of clovers, lucerne, &c., 8 to 12 per cent.; of turnips, rape, and swede seed, 7 to 10 per cent.; and of mangold, 12 to 16 per cent.

BUSHEL-WEIGHT.

True bushel-weight is the weight of seed in pounds which will fill a measure having a capacity of 1·28 cubic feet. This weight is dependent upon two factors—the density of the seed or grain itself, and the degree

of closeness with which, by virtue of its size, the seed is packed in the container. Thus it follows from the first-mentioned factor that full berried seed will show a higher bushel-weight than that with a small kernel and a large proportion of chaff, and from the second factor that small shotty seed will show a higher bushel-weight than larger-grained seed. The difference in bushel-weight between Akaroa and Danish cocksfoot is due to the difference in seed density, there being a greater proportion of chaff in Akaroa than in Danish. Again, the influence of the second factor gives small-seeded Hawke's Bay rye-grass a higher weight than Canterbury or Southern seed, there being less interspace in the Hawke's Bay seed.

The true or natural bushel-weight is used mainly in computing the value of undressed seed, which later, with one or two exceptions, is dressed up to its full weight—*i.e.*, the bushel-weight shown when chaff or light seed can no longer be economically removed. To ensure as close packing as possible brushes and polishers are used to remove bristles, &c., which would increase the amount of interspacing and lower the weight.

In New Zealand certain seeds are sold by the bushel—known as the standard bushel. This is an arbitrarily fixed weight, and has no relation to true bushel-weight. Thus the standard weight for rye-grass is 20 lb., and the purchaser receives 20 lb. for the stated price per bushel whether the true bushel-weight be 26 lb. or 32 lb.

Table 5.—Showing True and Standard Bushel-weights for Seeds and Grains.

Seed.	True Bushel-weight.	Standard Bushel-weight.
	lb.	lb.
Perennial rye-grass	18–32	20
Italian rye-grass	18–28	20
Cocksfoot	16–20	16–17 Akaroa.* 17–18 Danish.*
Crested dogstail	26–36	..
Timothy	45–50	..
Meadow-foxtail	6–12	..
Meadow-fescue	20–28	..
Chewings fescue	20–30	..
Poa pratensis	20–28	..
Red-top	36–40	..
Danthonia pilosa	4– 8	..
Danthonia semiannularis	2– 6	..
Paspalum	14–20	..
Prairie-grass	16–18	..
Cow-grass	64–66	..
White clover	65–68	..
Alsike	62–66	..
Lotus major	65–68	..
Wheat	65–68	60
Barley	65–68	50
Oats	65–68	40
Peas	65–68	60
Tares	65–68	60
Maize	65–68	56

* Fixed standard of true weight.

The term "standard weight" is used also with cocksfoot, but this refers to a fixed standard of true weight. Thus Akaroa cocksfoot is always sold at 16–17 lb., whereas other seeds have a wide range of weight. This 16–17 lb. standard is the weight to which all Akaroa seed is dressed, and when this weight is reached no more chaff, &c., is removed. Akaroa cocksfoot could be dressed up to a full natural weight of 20–22 lb., but the heavy dressing losses would necessitate an increase in the retail prices.

PURITY.

Most seeds on the market in New Zealand are machine-cleaned to a very high state of purity, and it is only in the low grade so-called pasture and clover mixtures (mainly dressings) that an excess of weed-seed is found. There are, however, certain machine-cleaned seeds which are liable to contain seeds of noxious weeds, and while some of these may not be a matter for great concern on certain poorer classes of land, their presence is dangerous in dairying and other than sheep-grazing country.

The weed-seeds referred to are Californian thistle in crested dogstail; dodder in clovers, Lotus major, and brown-top; ox-eye daisy in Danish cocksfoot and brown-top; and ragwort in Lotus major.

The following shows the number of seeds per pound represented by the presence of 1 per cent. of the more common seed impurities:—

Rib-grass	2,500	Ox-eye daisy ..	11,000
Catsear	5,300	Docks	3,000
Californian thistle ..	4,400	Sorrel	10,000
Dodder	13,000	Chickweed ..	12,000

MACROCARPA TIMBER IN FRUIT-CASES AND OCCURRENCE OF APPLE-SCALD.

INVESTIGATING recently the prevalence of a severe scald condition in a line of Sturmer apples in a cool store at Hastings, the writer's attention was drawn to the timber used for the construction of the cases in which scalded fruits occurred. In every instance one or two boards of macrocarpa cyprus were used. Further investigation gave conclusive evidence that these boards were responsible for the damage. A questionable case was selected from a number taken out of store for repacking, and was opened on a side made up of two pieces of timber, one a 7 in. macrocarpa board, the other a 4 in. insignis-pine board. Every apple in the three rows immediately beneath the macrocarpa was scalded, while those beneath the insignis pine were perfectly sound. In addition to the scald condition the fruit in close proximity to the macrocarpa boards was severely tainted, not only having a strong odour resembling that of creosote, but tasting equally strong. The miller of the timber, however, stated that it had not been treated with any such preservative. As there is no doubt as to the detrimental effect in this instance, it is clear that macrocarpa timber should not be used for fruit-cases.

—*N. J. Adamson, Orchard Instructor, Hastings.*

Orchard Registration and Tax.—For the official year of 1925–26 a total of 6,637 commercial orchards were registered and tax-demand notices issued to the occupiers by the Horticulture Division; £1,502 was collected in orchard-tax and handed over to the New Zealand Fruitgrowers' Federation less cost of collection. The tax is computed at the rate of 1s. per acre, with a minimum charge of 2s. 6d.

EXPERIMENTS ON MANURING OF TURNIPS IN CANTERBURY, SEASONS 1924–25 AND 1925–26.

A. W. HUDSON, B.Agr., B.Sc., Instructor in Agriculture, Christchurch.

IN the 1924–25 season one experiment on the manuring of turnips was conducted at the farm of R. S. Gunn, Racecourse Hill. In the 1925–26 season three on turnips and one on swedes were laid down at the same farm, but owing to the ravages of the grass-grub beetle in two cases, and the dryness of the early summer in the case of the swedes, only one of the experiments reached maturity.

A. Experiment in 1924–25 Season.

Date of sowing: 26th January, 1925. Varieties: Two-thirds Imperial Green Globe and one-third Fosterton Hybrid, sown at the rate of 9 oz. per acre in rows 14 in. apart. The paddock had been in grass previously. The manures used were :—

	Per Acre.
(1.) Superphosphate (42–44 per cent.)	1 cwt.
(2.) Ephos basic phosphate	1 cwt.
(3.) Nauru rock phosphate	1 cwt.
(4.) Super, ½ cwt., plus Ephos, ½ cwt.	1 cwt.
(5.) Super, ½ cwt., plus Nauru, ½ cwt.	1 cwt.
(6.) Super, 1 cwt., plus dried blood, ½ cwt.	1½ cwt.

Four replications of each treatment other than super were sown Super was used as the standard of comparison, and every third plot was sown with this manure. This arrangement allowed each treatment other than the standard (super) to be compared with a super plot immediately alongside it. The drill used was a 15-coulter machine, so that with 14 in. rows eight drills were sown to each width of the drill, which constituted a plot. Weighings made were taken from the three rows falling nearest the middle of the plot. Nine weighings, each 5½ yards long, were made in each plot, so that with four replications thirty-six weighings on the super plots were compared with thirty-six weighings on each of the other treatments. Total weights—roots and tops—were recorded.

The turnips on the super and super-plus-blood plots were the largest, but were evidently fewer in number. Hence it seemed certain that these treatments had an adverse effect on germination. This was tested in the following season, and is described below. The yields of the plots, which were weighed on 26th May, 1925, are shown in Table 1.

Comments on Table 1.

(1.) The yield of the super plots has proved superior to those of the Ephos and Nauru to the extent of about 2 tons per acre.

(2.) The mixture of super and Ephos shows an increase of about 18 cwt. per acre over super.

(3.) The super-plus-Nauru and super-plus-blood yields are not significantly different from those of the super.

Table 1.—Yield of Turnips, Season 1924–25 Experiment.

Area of individual weighed plot = $\frac{1}{754}$ acre.

Treatment other than Super.	Number of Paired Plots.	Yield per Acre.			Difference significant (S) or non-significant (N-S).*
		Treatment named in Column 1.	Adjacent Super Plots.	Difference (+) in Favour of Super or (−) of other Treatment.	
		Tons.	Tons.	Tons.	
Ephos	36	15·5	17·5	+2·0	S.
Nauru	36	16·0	18·2	+2·2	S.
Super and Ephos	36	18·9	18·0	−0·9	S.
Super and Nauru	36	18·4	18·2	−0·2	N-S.
Super and blood	36	18·3	17·8	−0·5	N-S.

NOTE.—An unmanured plot sown for the purpose of observation yielded 13 tons per acre.

* A difference is regarded as "significant" when the chances are greater than 30 to 1 in its favour. When the chances are less than 30 to 1 the difference is "non-significant."

B. Experiment in 1925–26 Season.

Date sown: 22nd December, 1925. Variety: Hardy Green Globe, sown at the rate of 9 oz. per acre in 14 in. rows. The manures used were the same as those of the previous season's experiment, with the exception of the dried blood, which was increased to 1 cwt. per acre. As before, the manure was applied to the seed rows with the seed. The method of sowing was as described in this *Journal* for July last, page 11. Twelve replications of each treatment were sown.

Effect of Manures on Germination.

To determine the effect of the various manures on germination, counts were taken (as described in the *Journal* for July, page 11) on 19th January, 1926, about a month after sowing. The means of forty-seven counts on each treatment are as follows:—

(*a*.) Super	14·6	plants per 10 ft. × 1 row.
(*b*.) Ephos	21·7	,,
(*c*.) Super plus Ephos ..	18·9	,,
(*d*.) Nauru	19·9	,,
(*e*.) Super plus Nauru ..	17·4	,,
(*f*.) Super plus blood ..	10·5	,,

The chances are greater than 24,000 to 1 that treatments (*b*), (*c*), (*d*), and (*e*) have a larger number of plants per unit distance than (*a*). The chances are equally great that (*f*) has a smaller number of plants per unit distance than (*a*).

The chances are about 1,350 to 1 that the mean of the counts of the Ephos plots is greater than the mean of the counts on the super-plus-Ephos plots.

Nauru has a superiority in number of plants over super plus Nauru, with chances of about 3,000 to 1 in favour of significance.

It is evident that the soluble phosphate—super—has had an adverse effect on germination, as compared with the insoluble phosphates—Ephos and Nauru.

Blood when added to super has still further increased the damage to germination. The smaller number of plants on the plots with the mixed phosphates, as compared with those having insoluble phosphates, indicates that even in the mixtures super has adversely affected germination. As will be seen in Table 2, there is no relationship between number of plants and yield, and it seems probable that if the bad effect on germination due to super can be overcome still better yields may result.

Observations during Growth.

At the time of taking germination counts, on 19th January, the super-plus-blood, super-plus-Ephos, and Ephos plots were slightly superior from the point of view of appearance. The Nauru plots were decidedly inferior, having small and yellow plants.

About five weeks later, on 23rd February, the super-plus-blood, super, super-plus-Ephos, and super-plus-Nauru plots were the best, displaying a deep-green colour as compared with a medium growth and pale-green colour of the Ephos plots. Nauru was decidedly poor. An unmanured plot sown for observation had practically nothing on it (Fig. 1).

The plots were weighed on 10th and 11th June, twenty-four weeks after sowing. All tops had died off. Fig. 2 shows the appearance of the plots at this date. The yields are given in Table 2.

Table 2.—Yield of Turnips, Season 1925–26 Experiment.

Area of individual weighed plots = $\frac{1}{778}$ acre.

Comparison A *versus* B.	Number of Paired Plots.	Yield per Acre.	Difference in Favour of A.	Difference significant (S) or non-significant (N-S).*	Number of Plants per 10 ft. (mean of 47 counts).
		Tons.	Tons.		
A. Super	32	15·5	0·8	N-S.	14·6
B. Ephos	..	14·7	..	..	21·7
A. Super plus Ephos	..	16·5	1·0	S.	18·9
B. Super	32	15·5	..	..	14·6
A. Super	8	16·5	7·2	S.	14·6
B. Nauru	..	9·3	..	..	19·9
A. Super	..	15·5	1·0	S.	14·6
B. Super plus Nauru	32	14·5	..	..	17·4
A. Super plus blood	..	18·8	3·3	S.	10·5
B. Super	32	15·5	..	..	14·6
A. Super plus Ephos	32	16·5	1·8	S.	18·9
B. Ephos	..	14·7	..	..	21·7

* See footnote to Table 1.

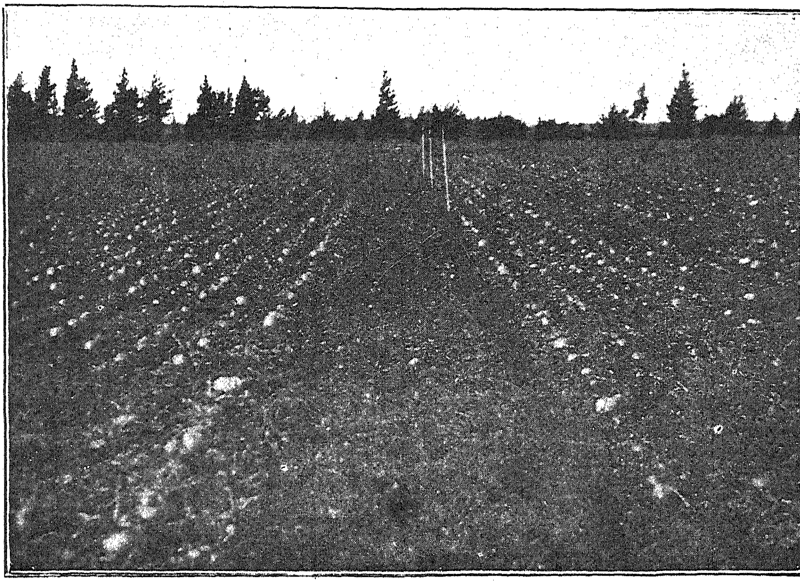


FIG. 1. AN UNMANURED STRIP (MIDDLE) IN ONE OF THE EXPERIMENTS.

This was sown for purposes of observation. Only a few small turnips are present.

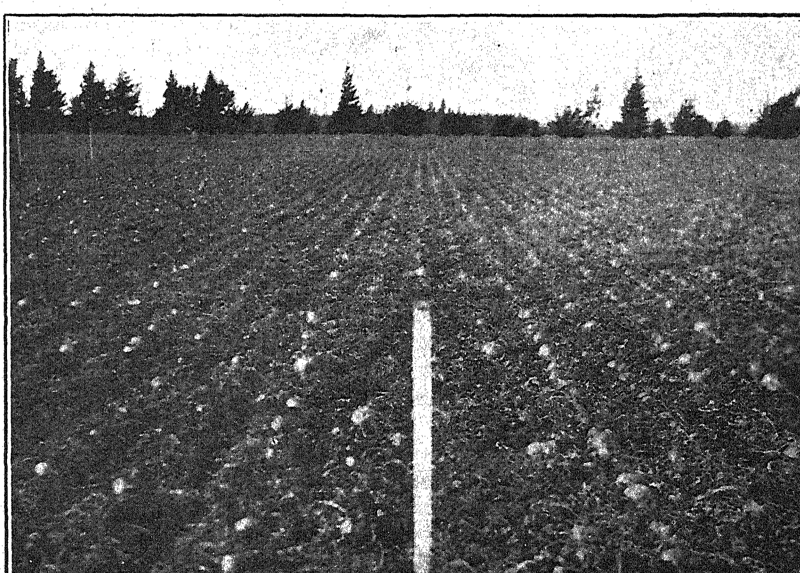


FIG. 2. APPEARANCE OF PORTION OF PLOTS AT TIME OF WEIGHING.

Four rows with pole in middle, super; four rows on right, Ephos; four rows on left, Nauru. The greater number of turnips on the Ephos plots is evident.

[*Photos by A. W. Hudson*

Comments on Table 2.

(1.) Although the difference in yield between the super and Ephos plots has odds of only 16 to 1 in its favour, it is probable that a larger number of weighings and consequent reduction in the probable error would have established the difference as a real one.

(2.) The mixture of super plus Ephos shows an increase over super of 1 ton per acre.

(3.) The very poor yield on the Nauru plots is in striking contrast to their behaviour in the previous season, when their yield equalled that of the Ephos plots.

(4.) The mixture of super and Nauru has not done as well as the straight super.

(5.) In spite of the great diminution in germination, the addition of 1 cwt. of blood to the super has increased the yield by about $3\frac{1}{3}$ tons per acre. The difficulty of arriving at the value of turnips makes it hard to measure the profit resulting, but if turnips were worth only 4s. per ton the increase would be sufficient to pay for the application of the blood. They must, however, be of greater value than 4s. per ton. In the previous season $\frac{1}{2}$ cwt. of blood did not increase the yield by a significant amount.

(6.) The mixture of super plus Ephos gives a decidedly better yield —to the extent of 1·8 tons per acre—than Ephos alone.

General.

The germination should be studied in conjunction with the yield. Undoubtedly the soluble phosphate is the most valuable form, and if its effect on germination can be overcome a considerable increase in yield should result. Whether the mixing with a slow-acting phosphate is justified must depend on whether greater benefit can or cannot be derived by eliminating this effect on germination. Further results must be obtained before the use of an expensive constituent such as blood can be recommended. Here also the germination effect must be considered.

It might be argued that thicker seeding would compensate for damage to seed, but in the writer's opinion this would not be satisfactory. Thinning due to manure does not take place uniformly, and no matter what the seeding is there would still be bare spaces alternating with closely growing ones.

Thanks are due to Mr. Gunn for his keen co-operation in the work. Mr. F. E. Ward was associated with the writer in the carrying-out of the experiment in the 1924–25 season, and his valued guidance and assistance are here acknowledged.

Honey Export.—The quantity of honey exported from New Zealand during the year ended 31st March, 1926, was 15,770 cwt., valued at £51,733. The following figures, showing quantities and values of honey exported from the Dominion during the preceding five years, are quoted for comparison: 1922, 8,542 cwt, £31,943; 1923, 10,605 cwt., £43,032; 1924, 9,157 cwt., £26,910; 1925, 10,836 cwt., £30,549.

RURAL SANITATION.

ADVICE FOR FARMERS.

New Zealand Department of Health.

THE necessity for as high a standard of sanitation in rural districts as in towns is essential if the health of the community is to be maintained. The institution and maintenance of a high standard of sanitation do not of necessity require a large expenditure. In most cases a little forethought in the planning and lay-out, followed by some attention later, will prevent objectionable conditions which militate against the well-being of the members of a particular dwelling and react more or less on the whole community.

The town-dweller has from a public-health standpoint some advantages over his country cousin, in that he is surrounded by restrictions which require that his house, when built, shall conform to certain standards and be properly drained, whilst the local authority takes the responsibility for providing him with a pure, wholesome, and plentiful supply of water, and the removal and disposal of all waste products from the dwelling, and generally endeavours to provide conditions which make for health. The responsibility for keeping the premises sanitary, however, rests with the owner or occupier, and in spite of facilities provided it is only too often evident that some people in our towns do not appreciate the value of sanitary conditions nor take the slightest interest in the health of the inmates of their homes.

On the other hand, conditions in the country are different. The country dweller frequently selects his site, plans the lay-out, builds his house and farm buildings, provides his water-supply, and makes provision for the disposal of waste products according to his own ideas and without reference to those who could assist him to start off along lines which would make for healthy living-conditions for himself and family. Fortunately, the question of rural sanitation has during recent years been receiving more attention than formerly, and by-laws are being brought into operation in different parts of the country ensuring that various health matters in connection with dwellings shall conform to certain standards. Much, however, still remains to be done, and the greatest progress will be made when the people as a whole begin to take an active interest in sanitary science.

In these notes it is quite impossible other than to touch on the fringe of the various subjects which come up for consideration, and whilst the major portion dealt with will be rural, other aspects will be applicable to urban and rural districts alike.

THE HOMESTEAD AND FARM BUILDINGS.

The homestead-site should be elevated, sunny, sheltered from prevailing winds, and preferably have a northerly aspect. Consideration should also be given to the nature of the subsoil, which should be such as will ensure a dry and therefore healthy site. One of the principal influences of the soil upon general health is through soil-moisture. Dampness in or near the surface of the soil may affect the health of those dwelling near by. Such a soil is cold, and the atmosphere immediately above it is liable to be damp, and this appears

to conduce to rheumatism, neuralgia, and diseases of the respiratory tract.

The dwelling should be so constructed as to prevent ground air or moisture or atmospheric moisture entering the building, and to this end the floor-timbers should be clear of the ground, efficient underfloor ventilation provided, damp-proofing carried out as necessary, spouting and downpipes fixed, and the whole structure built of good materials and in a workmanlike manner. Lighting and ventilation must also receive every attention.

Every consideration should also be given to the position and type of the farm buildings, thus helping to reduce the labour incidental on attending to stock, and simplifying the prevention of undesirable conditions.

WATER-SUPPLY.

Care must be taken that the water-supply is pure, wholesome, and plenteous. If the water is procured from the subsoil the well should be sunk in such a position and so constructed and finished on top that there is no danger of contamination. Where storage is necessary, care should be taken that the storage tanks are built of material which will not injuriously affect the water, and are so constructed as to be protected from dust and vermin. They should, however, be in easily accessible positions and provided with facilities for periodic cleansing.

DRAINAGE.

The method of drainage-disposal must be considered in relation to the local conditions, and always with a view to the avoidance of conditions which are objectionable or likely to be dangerous to health. A variety of means are available under different circumstances, and these may be briefly summarized as follows: (1) Discharge direct into the sea or large river; (2) land treatment; (3) liquefying-tanks and filter-beds.

The practice of discharging drainage on to street-channels and road-ditches has been all too common in the past, and has resulted in most objectionable conditions arising. When, however, the sea is available, or a large river which is not used as a water-supply, there can be little objection, excepting in certain cases, to the discharge of drainage direct into either. Where, however, isolated houses are so situated that a natural drainage outfall is not available, a very real problem has to be faced.

Surface irrigation or the discharge of waste water over the surface of the land is not a practice to be recommended for the average private dwelling; nevertheless in the case of houses with a limited water-supply and only a single fitting inside, it is possible for the waste water to be disposed of on freshly cultivated land, or around vegetables, without engendering objectionable conditions or encouraging flies or other vermin.

Subsurface irrigation carried out by laying lines of open jointed pipes some 12 in. below the surface may be employed. In this case the drainage is disposed of by soakage into the surrounding soil, and also taken up by the roots of surface vegetation. One of the difficulties in this method of disposal is to ensure that the drainage is equally distributed over the whole line of pipes, and for this purpose it is necessary, excepting possibly on sections with a steep gradient, to provide a collecting chamber with an automatic flush. Where the subsoil

is porous a soak-pit may be used, the main care which will be necessary in this case being to ensure that the surface of the pit does not clog. The provision of a small rectangular grease-trap, so constructed as to permit daily removal of grease, and so placed as to take the drainage from such interior fittings as the kitchen-sink, will usually obviate this. In a stiff clay artificial soak trenches and pits may be constructed, success depending in this case on the area of trenches and pits prepared, in comparison with the volume of drainage and the means adopted to utilize the whole soakage area.

In every instance where drainage-disposal is by subsurface irrigation or soak-pit, care must be taken to ensure that the underground water-supplies are not endangered. It should be remembered that the purifying action of the soil is largely dependent upon bacteria, and that this action takes place almost solely in the upper layers. If carcases are buried deeply, or if sewage is allowed to enter the soil at several feet below the surface, the process of purification is long delayed or checked. A leaking cesspool or broken drain which discharges its contents into the soil at a depth of 5 ft. or more may seriously pollute the ground-water, whereas the same material placed upon or just beneath the surface may be entirely mineralized, or all infection destroyed before it reaches a depth of 5 ft. Trees buried deeply where bacterial action is practically absent remain for many hundreds of years virtually unchanged.

SEPTIC TANKS AND FILTER-BEDS.

Where a good water-supply is available it is becoming increasingly common in country houses to install water-closets and construct septic tanks. Probably no other sanitary fitting has been so much discussed and so little understood by the average individual as the septic tank. The impression has got into certain minds that the septic tank is the be-all and end-all of sewage-purification, and if they but install a septic tank any liquid which may pass through the tank can be discharged anywhere without the danger of creating a nuisance. In spite of misconceptions, however, a properly constructed septic tank is a useful adjunct in certain systems of sewage-disposal, mainly because of its liquefying action on solid matters in the sewage. The effluent which passes from the tank, although it is still sewage, is nevertheless now in such a condition as to permit of further treatment either on land or filter-beds.

Filter-beds for sewage installations to private houses, except where they can be installed well away from dwellings and be under constant intelligent care, are not, however, to be recommended, because of the possibilities they provide for the creation of unpleasant odours.

DISPOSAL OF REFUSE.

The sanitary disposal of refuse, including vegetable refuse and manure, requires every care and attention. Vegetable refuse should, as soon as possible, be burned or trenched into the ground. The disposal of manure, particularly horse-manure, should receive the intelligent attention of every one interested in the well-being of the people. (This subject was dealt with in a previous article on "The Fly.") Horse-manure provides an ideal breeding-ground for flies, and whilst it may not be possible to eliminate the fly pest completely it is possible to considerably reduce their numbers and their rate of increase.

TESTING OF PUREBRED DAIRY COWS.

NOVEMBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

THE appended list gives details of performance of cows which received certificates during November, 1926. It will be noted the list includes a number of excellent records among the several breeds.

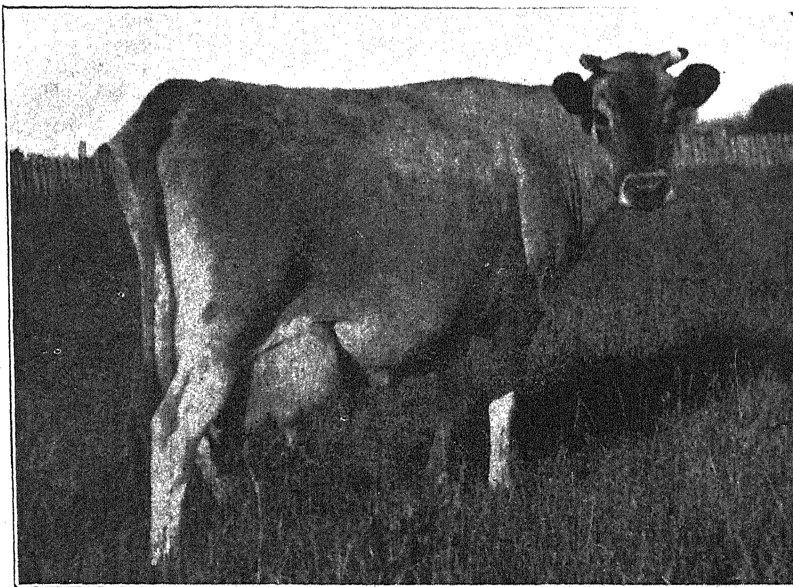
LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Alfalfa Supremacy	A. A. Wagstaff, Waihou	1 281	240·5	365	10,292·3	650·37
Oaklands Velyusa	T. M. Remington, Westmere	1 363	240·5	365	8,886·9	604·31
Oaklands Viscountess	T. H. Western, Bell Block	1 342	240·5	365	8,281·7	560·95
Miro Meadows Ruth	H. E. Walters, Waitoa	1 301	240·5	365	9,722·4	554·29
Brooklyn Lady Dolly	H. J. Lancaster, Glen Oroua	1 354	240·5	365	10,384·1	542·06
Waipiko Fairy Queen	S. H. Wearing, Richmond	1 322	240·5	365	9,445·4	541·66
Ku Ku Duchess	R. L. Horn, sen., Ohau	2 20	242·5	365	10,559·5	508·61
Jersey Brae Patch	T. Church, Te Rapa	2 14	241·9	365	7,844·7	507·58
Falconite Iris	G. E. Yelchich, Waiuku	2 13	241·8	365	8,424·7	494·12
Merivale Aster	A. R. Gudopp, New Plymouth	2 7	241·2	365	8,797·8	485·61
Waipiko Kasino	S. H. Wearing, Richmond	1 282	240·5	356	7,798·2	472·80
Rydal Blue Bell	T. M. Remington, Westmere	1 302	240·5	365	7,463·0	428·77
Craigalea Ruby	J. G. Robertson, Eltham	2 19	242·4	333	6,320·1	405·40
Silverlea Myrtle	W. D. Ross, Morrinsville	1 350	240·5	365	8,083·7	401·93
Beechlands Fortune Lady	A. Moreland and Son, Te Rapa	1 338	240·5	365	6,819·7	401·10
Orange Pet's Maid	W. T. Williams, Pukehou	1 303	240·5	365	7,757·6	390·92
Awaroa Dolly	Geo. Bright, Otaua	2 80	248·5	365	6,174·4	387·32
Fairlands Pretty	J. Klenner, Kaimata	2 37	244·2	331	6,106·0	383·50
Sea Lion's Choice	H. H. Phillips, Te Rehunga	1 342	240·5	365	7,161·2	380·22
Cowslip's Pearl	W. T. Williams, Pukehou	1 310	240·5	364	7,796·7	374·42
Tirohia Rosabelle	B. E. Veale, Tirohia	2 24	242·9	365	7,011·8	373·42
Surprise Packet	Geo. Bright, Otaua	1 358	240·5	365	6,765·4	368·38
Beechlands Gay Lady	A. Moreland and Son, Te Rapa	2 12	241·7	365	5,722·5	365·23
Mountain Meadows Rata	F. V. Green, Brixton	1 303	240·5	362	5,885·3	355·81
Jersey Brae Pansy	H. E. Focke, Te Awamutu	2 14	241·9	337	6,280·6	350·37
Grasmere Gala	H. J. Berry, Kaupokonui	2 0	240·5	364	7,091·6	347·98
Gowanlea's Elf's Maid	John Robb, Westmere	2 20	242·5	365	5,883·6	346·93
Beechlands Lady Emma	A. Moreland and Son, Te Rapa	2 19	242·4	300	5,935·0	342·22
Grasmere Prudence	H. J. Berry, Kaupokonui	1 356	240·5	342	6,206·1	329·98
Beechlands Joyful Lady	A. Moreland and Son, Te Rapa	2 41	244·6	324	4,995·5	311·14
Fairlands Stellata	J. Klenner, Kaimata	1 358	240·5	327	5,151·6	310·47
Queen of Pearls	A. Buchanan, Palmerston N.	2 7	241·2	365	5,650·7	307·00
Jerseydale Twilight	John Pettigrew, Pihama	1 323	240·5	269	5,474·6	268·62
Tongahoe Margaret	R. Hicks, Hawera	2 29	243·4	298	5,277·2	256·63
Waipuna Luna	H. C. Wallace, Tamahere	1 360	240·5	305	4,414·0	242·60

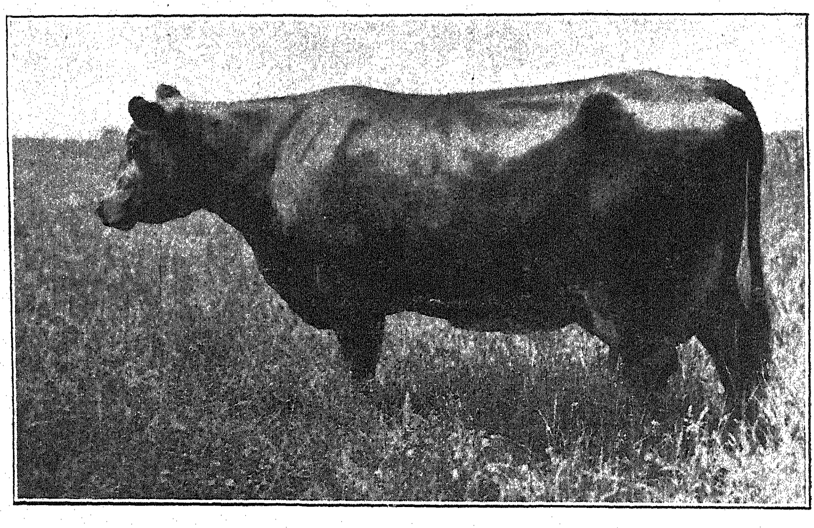
LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Senior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Craigalea Diamond ..	J. G. Robertson, Eltham ..	2 353	275·8	365	9,036·1	542·35
Glenavon Holly ..	J. Townsend, Puni ..	2 108	251·3	333	7,858·4	482·24
Lapwing of Heathcote	Mrs. E. E. Norton, Waimauku	2 318	272·3	365	8,191·5	460·26
Roma Lady Agnes ..	J. S. T. Short, Hawera ..	2 133	253·8	349	7,229·8	457·87
Edgarley Elegance ..	T. A. Millear, Tuakau ..	2 297	270·2	308	7,262·3	428·48
Jersey Brae Perfect Lady	H. E. Focke, Te Awamutu	2 132	253·7	292	7,745·2	380·00
Edgarley Delight ..	T. A. Millear, Tuakau ..	2 284	268·9	319	7,022·8	339·23
Merrie Meade Rani ..	H. C. Grierson, Papatoetoe	2 331	273·6	330	5,944·0	309·05
Three-year-old.						
Monandria	A. E. Watkin, Takanini ..	3 318	308·8	358	12,409·6	737·38
Alfalfa Senorita ..	A. E. Watkin, Takanini ..	3 254	302·4	365	12,974·2	725·84
Mac's Queen ..	A. E. Watkin, Takanini ..	3 345	311·5	365	11,396·9	632·24
Swan's Fox's Moo-o	A. E. Watkin, Takanini ..	3 36	280·6	365	9,789·7	606·34
Uruti Princess ..	W. Oxenham, Uruti ..	3 65	283·5	322	9,743·4	578·12
Tecoma Lady Sheen..	Mrs. E. E. Norton, Waimauku	3 3	277·3	365	8,949·3	564·27
Brooklyn Golden Rosette	H. J. Lancaster, Glen Oroua	3 321	309·1	365	9,686·9	550·51
Brooklyn Golden Lassie	H. J. Lancaster, Glen Oroua	3 316	308·6	365	9,095·7	543·93
Ku Ku Ranch Queen	R. L. Horn, sen., Ohau ..	3 339	310·9	335	10,238·4	471·11
Craigalea Adelaide ..	J. G. Robertson, Eltham ..	3 36	280·6	365	8,234·5	456·79
Braeside Sunbeam ..	J. Mitchell, Woodville ..	3 85	285·5	365	7,121·6	446·28
Hilltop Star ..	J. R. McDonald, Levin ..	3 87	285·7	333	6,911·8	403·59
Matai Nui Rosemary	D. L. A. Astbury, Mangatoki	3 316	308·6	269	6,067·6	335·79
Four-year-old.						
Gowanbrae K.C. Bluebell	A. G. Griffin, Richmond ..	4 319	345·4	365	13,794·8	685·66
Jersey Brae Favourite	A. E. Watkin, Takanini ..	4 40	317·5	365	11,072·0	593·12
Silver Dollar ..	G. S. Clarke, Te Awamutu	4 265	340·0	364	9,257·4	589·06
Waipiko Carauna ..	C. G. C. Dermer, Waipiko ..	4 275	341·0	365	10,555·0	570·17
Mature.						
Ivondale Dimple ..	P. J. Petersen, Brixton ..	5 15	350·0	365	10,756·2	739·09
Grafton Carnation ..	E. Feilding, Drury ..	8 38	350·0	365	13,024·2	728·29
Joli Bijou	A. J. Hale, Hillsborough ..	8 84	350·0	365	11,910·4	713·49
Salamis	F. W. and H. M. Clough, Inglewood	6 319	350·0	365	10,707·25	699·88
Jersey Meadows Iris..	H. H. Phillips, Te Rehunga	7 12	350·0	365	11,848·3	652·51
Fernaig Damsel ..	A. E. Watkin, Takanini ..	6 331	350·0	365	10·987·6	635·05
La Primavera ..	S. H. Wearing, Richmond ..	6 25	350·0	365	12,130·7	628·49
Bachelor's Fairy Queen	J. R. McDonald, Levin ..	6 140	350·0	365	8,995·5	583·21
Lady Pattie ..	A. E. Sly, Whakaronga ..	9 163	350·0	365	10,786·5	562·31
Jersey Lea Friskey ..	S. Bowker, Ihakara ..	5 37	350·0	365	9,113·9	542·01
Ururoa	F. V. Green, Brixton ..	6 23	350·0	334	8,464·5	534·05
Wisp's Beauty ..	W. Muir, Waihi	7 68	350·0	365	10,026·4	498·46
Pilot's Gem ..	T. Brownlee, Pukekohe ..	5 347	350·0	365	7,451·2	488·02
Edgarley Gold ..	T. A. Millear, Tuakau ..	5 335	350·0	365	8,385·9	462·75
Golden Tilly ..	J. R. McDonald, Levin ..	5 2	350·0	311	9,354·8	450·30
Glyndyfrdwy Belle ..	H. E. Walters, Waitoa ..	8 354	350·0	356	7,077·6	439·12
Ivondale's Clematice	A. J. Luxton, Omata ..	5 356	350·0	363	8,362·0	423·73
Snow View Snowflake	A. R. Gudopp, N. Plymouth	5 280	350·0	345	6,041·1	411·05
Larking	R. Hicks, Hawera ..	5 17	350·0	302	6,677·8	384·64



GOWANBRAE K. C. BLUEBELL (A. G. GRIFFIN, RICHMOND).

C.O.R. in Jersey four-year-old class: 13,794·8 lb. milk, 685·6 lb. butterfat.



DOMINION LUCILLA OF RUAKURA (R. S. ALLAN, HATUMA).

C.O.R. in Milking Shorthorn senior four-year-old class: 14,850 lb. milk, 635·9 lb. butterfat.

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Totara K.P. Lena Lass†	Piri Land Company, Auckland	2 117	252·2	309	11,358·3	452·42
Tikorangi Pearl No. 1	W. Bevan, Manukau ..	2 31	243·6	279	7,892·4	290·60
Senior Two-year-old.						
Ryvington Pontiac Cheer	Mrs. A. M. Hodgson, Tamahere	2 311	271·6	365	11,590·2	433·97
Junior Three-year-old.						
Pareora Hero Fancy*	A. S. Elworthy, Timaru ..	3 14	278·4	365	15,808·1	600·86
Ryvington Pontiac May	Mrs. A. M. Hodgson, Tamahere	3 16	278·6	365	11,166·4	433·20
Mature.						
Rosevale Burkeyje Sylvia*	North and Sons, Omimi ..	8 38	350·0	365	14,766·2	523·23
	MILKING SHORTHORNS.					
Senior Four-year-old.						
Dominion Lucilla of Ruakura*	R. S. Allan, Hatuma ..	4 325	346·0	365	14,850·0	635·91
Mature.						
Newstead Lucy* ..	E. Ridgley, Ridgway, Waiuku	14–15 years	350·0	365	19,864·5	748·21
	AYRSHIRES.					
Mature.						
Maesgwyn Hazel* ..	C. B. Morgan, Woodville ..	7 59	350·0	365	20,723·4	695·44
Velma of Edendale ..	W. Hall, Lepperton ..	6 10	350·0	365	12,889·0	444·13
	RED POLLS.					
Two-year-old.						
Otahuna Nancy* ..	G. S. Young, West Plains ..	1 315	240·5	309	7,744·0	291·99
Otahuna Countess* ..	G. S. Young, West Plains ..	1 349	240·5	292	6,601·4	276·79

Noxious-weeds Order.—The Mauriceville County Council has declared, with respect to its territory, that Californian thistle is *not* a noxious weed, and that gorse and pennyroyal are noxious weeds under the Act; further, that all its previous declarations regarding noxious weeds are revoked.

Importation of Animal-manures.—The annual report of the Live-stock Division for 1925–26 states that during the year the importation from Australia and India of animal-manures sterilized under supervision did not, for various reasons, come up to expectations. Considerable difficulty was experienced in obtaining freight to New Zealand for even small consignments, and in addition seamen's and railway strikes in Australia hampered, and at times entirely suspended, business in this direction with New Zealand. The organization in regard to the supervision of the sterlization of animal-manures from India and Australia has been maintained, but it is a matter for consideration whether, in view of the limited imports to New Zealand of animal-manures, the Department should not now withdraw its organization from one at least of these countries and so confine the source of supply to one place.

SETTING AND ADJUSTING OF LEVER PLOUGHS.

SEVERAL correspondents have lately drawn attention to the very common lack of knowledge on the part of the average ploughman as regards the setting, &c., of his plough. At our request the following useful notes on how to set and adjust lever ploughs for work have been kindly contributed to the *Journal* by a practical expert in farm implements :—

First fit on the shares. Then measure from bottom of point of shares to top of beam, next from bottom of back wheel to top of beam, then from bottom of front wheel to top of beam. These measurements should all be the same, so that the plough will be on the level. It is most important to note that if a plough is worked with both front and back wheels, or either of them, ½ in. or ¾ in. higher than the share level, the draught is increased enormously. Therefore it is imperative to keep the plough at the levels mentioned.

In soft ground the wheels may be set a little lower than the point of the shares, but *never higher*, unless in striking out or in finishing, when the front wheel may be altered to suit. The back wheel must always be kept at its proper level. The depth of furrow is got by adjusting the land wheel alone.

When ploughing on hillside the skeiths should be set up off and well back over the shares. A straight-edge placed along the bottom side of back wheel should run towards the land about 2½ in. to 3 in. at the point of share. Then as the plough slips downhill the back wheel works up and regains the lost ground. In hillside work it is also advisable to use narrow shares and turn the widest furrow possible, according to the class of land being ploughed.

In ordinary ploughing never cut the furrow right through, as this is inclined to stand the furrow on edge ; about 1½ in. to 2 in. break is required. This means that if shares 9 in. wide are being used the plough should be opened out at the front wheel crosshead to between 10½ in. and 11 in., and the *break* is the difference between the width of the share and the actual furrow ploughed.

The skeiths should be set about ½ in. to the land side of the share, and about 1 in. (more or less) *above* it, according to the class of ground being ploughed. In hard or stony ground the skeiths should be lifted up off the shares and well back over them. In soft ground this should be reversed—skeiths well forward and well down.

It will be noticed that when the back wheel wears the back furrow gets smaller, and that when the front wheel wears the front furrow gets larger. To remedy this tie top of back wheel to beam of plough, then place straight-edge from land point of share parallel with the beam to the back wheel ; next fit in packing to adjust the back wheel until it goes over against the straight-edge. This is called the "line of draught," and is vital to the good working of the plough. When the back wheel gets worn, or the back-wheel stalk gets bent, the plough swings round towards the furrow and will not hold the land. Next adjust the front-wheel crosshead stalk until both furrows are the same width.

Before starting work it should be seen that all wearing parts of the plough, such as skeiths and wheels, are properly oiled or greased.

SEASONAL NOTES.

THE FARM.

CEREAL HARVEST.

Most of the cereal crops will be ready for cutting during January, and any slack days during the early part of the month can be spent profitably in overhauling binders. Canvases should be repaired, knives sharpened, damaged parts replaced, oil-holes cleaned out, and the whole machine thoroughly oiled. This will probably save a good deal of time and worry during cutting operations.

Oats should be cut somewhat on the green side, and allowed to ripen in the stook. Wheat should be cut when all straw except a small portion above the highest knot is yellow; knots should be green, and grain firm enough to cut with the thumb-nail. Barley must be fully ripe before it is cut. The straw should be free from any trace of greenness, and when this stage is reached the grain will have assumed a finely wrinkled appearance.

Care should be taken in stooking, for this is an important operation, and if carried out in the correct manner will save much waste. Sheaves should not be allowed to lie long on the ground; it is advisable for cutting and stooking to proceed simultaneously. If the sheaves contain much green rubbish they should remain in stook until all this is dead; otherwise they will heat in the stack and the grain be damaged. A better sample of grain and one more appreciated by the miller is obtained if crops are stacked and allowed to mature before threshing. If stook-threshing is carried out special care must be taken to see that the grain is in fit condition.

CATCH-CROPS.

As the coming month advances, and stubbles or land which has grown early soft turnips or other fodders becomes available, every endeavour should be made to get in suitable catch-crops. It should be remembered that vacant land encourages weed-growth, if not already present, when the crops are removed. Weed-growth at this period is often in a comparatively weak state, and is easily killed with a minimum of cultivation if the weather is at all seasonable. Unless such weeds are of a particularly persistent nature there will be no need of a bare fallow. Where conditions necessitate ploughing, this should be very shallow in order not to unduly dry out moisture, but in many cases grubbing will be sufficient.

If it is intended to autumn-sow grass there may still be time to provide a quick crop like mustard for ploughing in, which is of great advantage on light-textured soils. A suitable sowing is 12 lb. to 15 lb. mustard with 2 cwt. to 3 cwt. of super per acre.

Land not required until spring can be sown with Black Skinless barley for very quick results, or for later feeding with Algerian oats and Scotch tares; a temporary pasture of Italian or Western Wolths rye-grass and clover is an alternative. Sow 2 bushels to 2½ bushels of Black barley, or 2 bushels oats and 1 bushel tares, or 30 lb. of either Italian or Western Wolths rye-grass, or 15 lb. of each with 5 lb. or

6 lb. of red clover, using in all cases 2 cwt. to 3 cwt. of super or other suitable phosphatic manure.

PREPARING FOR AUTUMN SOWING OF GRASS.

The preparation of areas to be sown down in permanent pasture during autumn should now be kept in view. While many factors are important in the establishment of a good pasture, it must be admitted that late ploughing and hurried cultivation are the cause of many failures. A properly sweetened and consolidated bed is imperative, and this cannot be attained by hurried rolling and working alone. As with all cultivation, nature must be permitted to do her share; hence it is necessary that preparation should be commenced at least a few weeks before sowing. Varieties to constitute the mixture should be chosen with care and suited to the particular conditions of soil and climate.

As the maintenance and permanency of good pastures is becoming better understood, greater care in laying down permanent grassland must follow. Top-dressing, although valuable and important, will give its best results at a later date where the pasture has been properly established. If grass is to follow a crop eaten off by sheep, and provided the land is clean, it is often better to disk rather than plough, in order to retain consolidation and keep the animal-manure near the surface.

TURNIP AND RAPE CROPS.

Sowings of yellow- and white-fleshed turnips for late winter feed may be made in January. Of the former, Purple-top and Green-top Aberdeen do best in the wetter and colder districts, while of the latter, Lincolnshire Red and Imperial Green Globe are suitable where the average annual rainfall is below 30 in. Late sowings of rape may also be made. When this is done it is usual in various districts to drill in Western Wolths rye-grass at the same time. This supplies late autumn and early spring feed.

The earlier-sown rape crops should now be ready for feeding off. Ewes and lambs or newly weaned lambs are best turned on when the leaves are a bluish-purple in colour. Care should be exercised in the feeding of this crop, or losses are likely to occur. Stock should not be put on when they are very hungry or when the crop is wet, else they are liable to become blown. It is safest to commence feeding on small blocks, and only for a short time. Lambs on rape should have a good pasture run-off.

SUPPLEMENTARY FEEDING OF DAIRY COWS.

The period following New Year is often the most critical period in the dairy-farmer's calendar. December sees most of the grasses reach maturity, and with normal summer weather the next few weeks show a marked decline in the production of the pastures. This coincides with and tends to encourage the natural tendency for the cows to dry off, or at any rate to markedly drop in their milk-yield, and a good supply of succulent food coming forward as the pastures decline will make all the difference in butterfat - production. Lucerne, maize, Japanese millet, and early-sown soft turnips provide very useful January feeding. Ensilage, too, acts as an excellent brake on the downward trend of production.

PEAS FOR LAMB-FATTENING.

Where peas are grown for lamb-fattening a start should be made to feed off when the main crop of pods are full and just getting hard. If stocked earlier lambs do not like them and there is considerable waste. If the weather continues dry practically every pea will be picked up from the ground. Lambs should not be confined on pea crops at first, as it takes them a little time to get used to the peas, and during the first week they should have access to other feed to keep them going. After about a week the peas are readily eaten and the necessity for other fodder is not so great. At the same time lambs fattening on peas will always do better if they have a run-off. They should also be provided with plenty of drinking-water.

LUCERNE.

Young lucerne stands may require mowing towards the end of January or beginning of February. It is better to allow the young plants to strengthen than mow too early, unless weed-growth is likely to be troublesome. Provided the weather is dry, old stands should be thoroughly cultivated to eradicate grass, &c., as opportunity offers after mowing. Young stands should be given light cultivation as they become better rooted, with the same object in view. Grazing of well-established stands by stock should be carried out in blocks, as lucerne will not stand constant nibbling.

Lucerne may be sown up to the end of February, at the rate of 10 lb. to 12 lb. in 7 in. drills or 6 lb. to 8 lb. in 14 in. drills. On average soils a covering of $\frac{1}{4}$ in. to $\frac{1}{2}$ in. is sufficient, and even on sandy soils the depth should not exceed 1 in. The failure of many crops to germinate well has been due to too deep sowing. —*Fields Division.*

THE ORCHARD.

SPRAYING.

It will be necessary to continue spraying in accordance with the instructions set out in the calendar published in the September *Journal* notes. All fallen and codlin-moth-infested fruits should be gathered and destroyed immediately, so as to prevent the escape of the grubs from the fruits. If this is done it will greatly assist in controlling this pest. The cherry and pear slug will now be in evidence, and two or three sprayings with arsenate of lead should effectively keep the pest in check. On cherry-trees on which the fruit is nearly ripe it is advisable to use hellebore powder, 1–20, as it does not stain the fruit as does arsenate of lead. In orchards where red mite, apple leaf-hopper, and aphis are in evidence every effort should be made at this period by thorough and careful sprayings to control these pests.

During the spring and early summer months cold and showery weather has been generally experienced, and in consequence such fungous diseases as brown-rot of stone-fruits and black-spot of the apple and pear will be prevalent in localities where these diseases are established. For the control of brown-rot it is necessary to supplement the spraying programme by carefully going over the trees

frequently and cutting out all infected laterals, shoots, and other wood. The trees should be sprayed thoroughly up to within a fortnight of picking.

DISBUDDING.

This operation should be regularly attended to now, and all shoots below the grafts removed. All superfluous shoots should also be removed from the roots and trunks. Surplus and misplaced growth in the heads of the trees—particularly young trees—should, if not already attended to, be carefully cut out or pinched back now.

BUDDING.

The reworking of trees by budding may be carried out from the middle of January until the end of February. Budding is merely a form of grafting in which buds are used instead of scions. Each bud is an individual plant, and under certain conditions is capable of forming a tree. The operation may be performed in various ways, but the usual and most general way is by what is termed shield or T budding. To do this make a straight perpendicular cut in the bark of the stock about 2 in. long, and at the top a cross cut so that the two cuts form a T. Raise the bark from the top with the point or the handle of the budding-knife, so that the bud may be inserted. Push the bud down as far as required, and tie carefully with raffia. Only mature buds should be used. The buds are prepared by cutting them with a sharp knife from the shoot, with a portion of the bark and a thin piece of wood attached. Cut the top of the bark square. Care must be taken in cutting that the bud is not injured when it is removed from the shoot. The leaves should be cut off, leaving a portion of the stalk to assist in holding the bud when it is being inserted into the stock.

PICKING.

The harvesting of stone-fruits will have commenced, and it is important that every care should be exercised in the handling of the fruits. It is also necessary that they should be well graded, and packed in the most attractive manner possible. The states of maturity at which these fruits should be picked were dealt with in the November *Journal* notes. The earliest-ripening varieties of apples will soon be ready for picking. The matured fruits should be selected from the trees as soon as they are ready, and sent to market, as remunerative prices are usually obtained for these early fruits. Small and immature fruit should not on any account be picked, but should be left on the tree to mature. —*W. K. Dallas, Orchard Instructor, Dunedin.*

Citrus-culture.

Cultivation of the soil should be constantly attended to at this period. It is not desirable to allow to grow between the trees any crop which would draw in the moisture of the soil during summer—not even weeds. Clean and constant cultivation all summer should be the aim. On no account should a heavy crop of green material be turned under during dry weather. It is best dealt with by a few strokes of the disks, when it will be worked into the surface soil. If ploughed in it will form an insulating stratum of undecayed matter between the surface and lower soil.

Spraying: During the coming month the main crop of oranges and lemons will be at the most critical stage for the season, with young, tender, and rapidly developing fruits which require protection against thrips, mites, and young scales that are apt to become established at this period. The lengthy flowering-period of the lemon results in fruits developing after the main crop has set and been sprayed for scab and verrucosis. Repeat applications of 4–4–40 bordeaux are therefore necessary in order to ensure all fruit being protected from the early stages. Suitable sprays for insects are oil, 1–60, or nicotine, 1–800. The latter may be added to any bordeaux spray being applied, or 3 lb. soap for 100 gallons should be added if used alone.

Pruning: At this season many undesirable growths of rank wood are made on the inside of the trees. These should be cut out, being of little fruiting-value and causing overcrowding. Extending growths are also made by the main parts of the tree, often extending 2 ft. to 3 ft. before natural division takes place. Such growths should be dealt with by pinching at 12 in. to 16 in. in length so as to cause the division at a more suitable place. Attention to this work when the shoots are young obviates the necessity for later hard cutting to bring the extended growths within bounds.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CLEANING UP AFTER HATCHING AND REARING.

Now that the work of hatching and rearing is over, all incubators and brooding-appliances should be thoroughly cleaned and disinfected before being set aside. Lamps should be well scoured in boiling water. In addition, the regulating-appliances of the incubator should be disconnected and placed inside the machine. This will prevent these parts from becoming damaged, which is too often the case during the off season. Especially does this apply to the connecting-rod, and when things are thrown carelessly on top of the machine. Once a connecting-rod becomes bent it can never be depended upon, and is obviously a common cause of incubators not regulating properly and producing poor hatches.

The brooder runs should also be dug up, limed, and sown down, everything being done, in fact, to ensure for these a clean condition and a good growth of grass next spring.

BROODING DUCKLINGS.

Several cases have come under my notice lately of ducklings losing the power of their legs during the brooder stage. This is usually the result of allowing the birds to sleep in damp quarters. Although ducks are water-fowl, ducklings produced under artificial conditions will cease to thrive if compelled to sleep on damp bedding or where a moist atmosphere exists.

Once a duckling loses the power of its legs little or nothing can be done for it. It is really a matter of prevention by checking everything that tends to create a moist atmosphere. In the first place, the drinking-vessels should be placed well away from the sleeping-quarters,

which will help to keep the latter dry. Ample ventilation should also be provided, and the quarters kept clean. Do not on any account overcrowd ducklings by placing more in the brooder than it can properly accommodate. Work only with numbers that can be handled with absolute confidence. An even degree of warmth, good ventilation, and dry and clean quarters are essential factors in rearing brooder ducklings.

Young ducklings should be always protected from hot sun, as, having a thin skull, they are very prone to sunstroke, which is a common cause of heavy mortality. When a duckling becomes affected with sunstroke it gives every appearance of being in a fit. It will be observed to fall on its back, with the eyes twitching, and generally presenting a distressed condition. Ducklings which have had a long fast and are then given food and water will often behave in a similar manner, and with heavy mortality.

The only way of preventing this trouble is to have water within reach of the birds at all times, both by day and night. Where it is found that the drinking-vessels are empty, and the birds have been without water for some time, it is a good plan to take the chill off the water before giving it to the birds to drink.

LEG-WEAKNESS IN BROODER CHICKENS.

Several complaints have reached me of chickens being affected with leg-weakness. This trouble usually affects the young birds when from three to five weeks old, and, apart from the loss of leg-power, they often present a healthy plump condition. At first the affected birds will have an unsteady walk and a slight spreading of the legs. From then onward the legs gradually get weaker, until the bird is unable to stand. Even at this stage they may still bear a healthy bodily appearance, and will eat greedily if food is placed before them. Leg-weakness is often confused by poultry-keepers with rheumatism, and in their endeavour to effect a cure they rub the legs with liniment, &c., but seldom or never with the desired effect. This trouble is usually due to huddling and the need for greater warmth. The huddling effort and the desire of the chickens to secure an inside position, which is necessarily the warmest, has the effect of spreading their delicate legs. The trouble is often intensified by insufficient bedding on the floor of the brooder, especially when the floor is very smooth—the constant slipping on the smooth surface having the weakening effect on the legs.

There is practically no way of curing leg-weakness—prevention is the only feasible way of dealing with it. The first step to this end is to provide the desired warmth demanded by the chickens. This will induce them to spread out over the floor of the brooder—a sure indication that they are enjoying the comfortable degree of warmth that instinct demands. It is also a good plan to place a piece of sacking over the floor of the brooder on which the bedding—chaff, &c.—is placed. This will give the chickens a foothold in the event of their huddling, and prevent slipping and its consequent effect on the legs. In addition, the chickens should be provided with plenty of exercising-space, as without this, in the case of chickens when about a month old, the body is apt to become too heavy for the delicate legs to carry, and as a consequence the latter become affected.

CLEAN GROUND ESSENTIAL.

In these days of progressive ideas in poultry-culture one of the most important facts evolved is the necessity of clean ground for the maintenance of healthy stock. This necessity is of special importance in the raising of brooder chicks. Not only should the brooder runs be kept clean and fresh, but every possible provision should also be made to place the young birds on fresh ground when they are drafted from the brooder. Dirty or what might be termed poultry-sick soil means the encouragement of disease and parasitic life, and these come into the category of those things which cannot be properly cured. Too many poultry-keepers are not aware that intestinal worms are often responsible for heavy losses in comparatively young chickens, say, from six to eight weeks old. Scores of such cases have come under my notice, and in almost every one the trouble could be traced to tainted ground.

Above all, never allow chickens—or, indeed, poultry of any age—to have access to a manure heap which has been collected from time to time out of fowl-houses, or intestinal parasites are almost sure to give trouble. On one plant where my advice was sought in regard to mortality among chickens, and where the natural method was adopted for hatching and rearing, the owner declared that the young birds did well till the hens and their broods were let out of their coops and given a free range. The cause of the trouble was not far to seek, for immediately a hen and chickens were let out of their coop they made straight away to a manure heap. This not only consisted of cleanings from poultry-houses over a long period of time, but in addition it was made the dumping-ground for dead carcases of fowls and practically all kinds of rubbish. In the circumstances it was little wonder that heavy losses were taking place, due to intestinal worms.

It must again be emphasized that if the young birds are to develop into vigorous and profitable stock they must have everything in their favour, and I do not know of anything more conducive to this end than clean ground to run on. I have always favoured alternate runs to a poultry-house, in order that the birds may have frequent changes to clean ground after it has been cropped and rested. Longer experience in utility-poultry keeping has only strengthened, to my mind, the importance of this practice.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

SUPERS.

WHEN the honey-flow commences everything should be in readiness to take advantage of the too often brief season. Care should be taken that sufficient supers are on hand to care for the largest crop. Failure to make provision beforehand loses the industry many tons of honey in a good season. During bad seasons the beekeeper is apt to neglect his equipment and otherwise allow his stocks of supers to become depleted. This is bad policy, as supers can be stored without injury, and when the big yield comes repay their cost many times over. Do

not allow the bees to loaf or cluster outside for want of room. The work of adding supers must not, however, be done in a haphazard manner, nor the bees be disheartened by being given too much room at one time. The supering of weak colonies taxes the bees in keeping up sufficient warmth in the hive on cold nights, and prevents them from building up. It is well when adding additional supers to place them between the brood-chamber and the first super, or at least to raise a few frames of honey from the first super into the second when adding the latter.

QUEEN-EXCLUDERS.

January is the month when queen-excluders are of most use, especially in southern districts. Whatever their disadvantage may be in some localities, in the South they have proved their efficacy in enabling the apiarist to finish extracting before the hot weather goes, without the destruction of any brood whatever. They should never be used for general purposes until the main honey-flow is in full swing. By that time the bees are used to working in the supers, and with nectar in abundance to be had all around them they will woık cheerfully right through the hive, passing through the holes in the excluders as if no obstruction existed.

The best method of using the excluders is as follows: All sealed brood should be raised above the excluder, and the queen confined below on drawn-out combs. The brood above the excluder should be watched for a few days in case any eggs have been elevated, as the bees will sometimes attempt to raise queen-cells above the excluder. If this happens the queen-cells should be destroyed, as the queens which will emerge from them will not be able to pass through the excluders to get mated, and will in time develop into drone-layers. By providing the queen with plenty of empty comb she will be able to cultivate laying at a sufficient rate to keep up a supply of workers, and as the brood hatches out in the upper stories the cells will be at once filled up with honey.

Excluders are often condemned as being productive of overswarming, but in many localities swarming ceases automatically as soon as the main honey-flow commences; and if the queen is allowed plenty of room in the brood-chamber, and the brood in the supers is carefully watched for the production of queen-cells, very little harm can come from the use of excluders, while the immense advantage of being able to extract combs entirely free of brood is worth a great deal to the apiarist at his busiest season.

VENTILATION.

The matter of providing ample ventilation must not be overlooked, for at this season of the year bees require abundance of fresh air day and night. Clear the hives of weeds and grass. Strong colonies may be given full-sized entrances. If the bees show a tendency to cluster at the entrance ill-ventilated hives may be the cause. This condition is a factor in excessive swarming, and in any case a large force is employed in carrying out work which can be obviated to a large extent if the beekeeper will study the requirements of his bees. In cases where the bees show a tendency to cluster at the entrances the front of the hive may be wedged up an inch or so. When honey is coming in freely there need be no fear from robbing.

HONEY-TANKS AND HEALTH REGULATIONS.

At this period, when making preparations for the handling of the season's crop, it is well for beekeepers to contrive to meet the demands under the regulations in relation to the storage of moist foods. Section 21, subsection (1), of the regulations under the Sale of Food and Drugs Act, 1908, provides that no person shall use in the preparation, packing, storage, or delivery of food for sale any package, container, or appliance used for manufacturing, keeping, or holding a moist food which has in contact with the food a surface composed of lead or zinc. Since honey is a moist food, the above regulation clearly prohibits its preparation and storage in tanks and extractors the metal parts of which have in contact with the honey a surface composed of lead or zinc.

Prior to the war tinned-steel containers were almost exclusively used by beekeepers for the storage of their product. The scarcity and high price of tinplate led the manufacturers of beekeepers' requirements to utilize galvanized iron, and thus to-day a large number of honey-tanks constructed of this material are in use. The advice given by the Health Department that all such vessels should be scrapped, and the additional warning that the regulations are to be enforced, cannot be treated lightly or ignored. There is a danger that honey stored in vessels the surface of which is composed of lead or zinc may be contaminated and its quality thus destroyed. The safest course to follow is to scrap all such containers and install new equipment in time to handle the season's crop. Where arrangements cannot be made to do so immediately, it is recommended that precautions be taken to coat the inner surfaces of the extractors and tanks with beeswax; but while this will guard to some extent against the danger that exists when honey is exposed to deleterious metals, it should be treated as a precautionary measure only, and should not deter beekeepers from installing equipment that will comply with the regulations in force.

REGISTRATION OF APIARIES.

Beekeepers are reminded of the necessity of applying for the registration of their apiaries, which is being called for in compliance with the regulations under the Apiaries Act, 1913. Cards of application have been despatched to all beekeepers in the departmental register, but should any person requiring same not receive a card he should make immediate application for one. The cards are obtainable from the principal district offices of the Department of Agriculture, from the Director of the Horticulture Division, Wellington, or from any of the larger post-offices throughout the Dominion. Registration is free; the penalty for non-registration is a fine not exceeding £5. Beekeepers are requested to note that provision has been made on the registration card for a declaration as to the quantity of honey and beeswax produced during the season ended 31st May, 1926. This information is being sought through the Department by the Government Statistician under the Census and Statistics Act, 1910. In the circumstances beekeepers should appreciate the need of prompt and accurate returns being rendered as early as possible.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

THE TOMATO CROPS.

After visiting a number of tomato-growers early in the season one is impressed by the heavy losses incurred by the neglect in regulating the temperatures and humidity in frames and glasshouses, and chilling plants by putting them out in the field without properly hardening them first. An average crop is sometimes obtained under these circumstances, but late in the season, and more often even that result is missed through a poor setting of the fruit or serious attacks of disease. It is no doubt a fact that most of the disease among such crops is due to wrong cultural methods, which cause debility and allow plants to become an easy prey.

Among the wonders of organic life nothing exceeds the physical adjustments a plant makes to accommodate itself to changes of temperature and humidity; the functions are retarded or accelerated, and the leaf-surfaces are enlarged to increase the transpiration of moisture. But with the grower's object of a large and early crop the energies of the plant cannot be allowed to be taken up by such adjustments; the objective can only be fully attained by steadily maintaining the optimum conditions, and for the tomato-plant these are a temperature of 55° to 65° F. and a dry buoyant atmosphere. To produce early plants under the changing weather conditions of early spring, when one is busy with many other duties, is not easy, but it is necessary. It is best done by having the frame-yard in a handy central position, and some one appointed to specially attend to ventilation and watering; it is a duty requiring the greatest skill and experience.

Much has been said of late regarding the necessity of giving more ventilation to the tomato crop when grown under glass, so as to prevent the early development of leaf-mould fungus on the foliage. But to have bottom and top ventilators open when a cold wind is blowing and chilling the plants is to weaken them and make them an easy prey to disease. The one excess is equally as bad as the other. When plants have been well grown in the frames, to place them out in the cradles to harden, or plant them in the open without proper preparation, is entirely defeating the object in view. The hardening process should be graduated by giving more ventilation in the frames as the weather becomes warmer, and when the plants are placed in the cradle to harden a hessian cover should be handy to shelter them from sudden storms or fall in temperature. If exposed at this period to any sudden change the growth is stopped, and the first bunch of blossom, which is of most value, is lost or seriously damaged.

In some instances, where plantings in the field are extended over a considerable period, it is customary to make one sowing and allow plants to remain in the boxes until they are required. The plants under this treatment do not die, but the check received seriously diminishes the crop or delays the harvest. For an extended planting-period several sowings should be made, so that plants may be taken from the boxes as soon as they are ready and before any check is given to their growth. Such attentions achieve the objects in view, and dispense with a lot of anxiety with disease and spraying and feeding backward plants.

BERRY-FRUITS.

Harvest in the berry-fruit section is drawing to a close, and it is to be remembered that the next season's crop largely depends on the autumn treatment of the plants. Strawberry-beds that are worn out may be ploughed under and the land prepared for other crops. Where the beds are to be carried on for another year they should be cleaned up and the plants encouraged to make good growth.

Raspberry and loganberry breaks will require to have the old fruiting-canes removed; and in all cases these crops should be carefully examined for any sign of disease or pests, and suitable sprays supplied now, as required, so that clean, well-grown fruiting-wood will be available for the coming season. Where further plantings are to be made the present is a suitable time to commence preparing the land by thoroughly cleaning it and giving it deep cultivation, as these shallow-rooting crops allow little of this kind of work to be done after they are once planted out.

THE VEGETABLE-GARDEN.

In the vegetable section many crops will now be ready for harvesting. When this is completed the land should be taken in hand, and if not required for immediate cropping it is best sown down in a suitable cover-crop for turning in later. The opportunity for administering this valuable manurial treatment should not be missed.

Among the crops harvested will be the early potatoes, and the grower will be well repaid by making a careful selection of seed tubers. They should be taken from well-grown plants true to type, the tubers being about the size of a hen-egg and slightly immature. The practice of storing seed potatoes in well-ventilated banana-cases is quite a good one. If stored in sacks care should be taken not to pile these up or to allow the tubers to heat in any way. In dry weather the danger of infection from potato-moth should be avoided.

If the weather at this season is wet, late blight in the main potato crop is sometimes troublesome. Experience has amply demonstrated the efficiency of bordeaux mixture, 4-4-40, applied fortnightly, to give a large measure of protection to the foliage and thus allow the tubers to complete their growth. The strength of the spray is sometimes increased for the later applications with good results.

Advantage of our mild autumn season may now be taken by sowing dwarf peas and beans, spinach, salads, turnips, early shorthorn carrots, and the popular beet-root.

The planting out of winter crops of savoy, cabbage, cauliflower, broccoli, kales, celery, and leeks should now be completed.

TOBACCO-GROWING.

Between two and three months after planting the terminal growths of tobacco-plants develop flower-buds, which are an indication that the vegetative growth has been completed and the business of seed-production has commenced. To prevent the deterioration of the leaves —which would quickly follow this development—the flower-buds are removed with as much of the remaining growth as is unlikely to produce well-developed leaves. This operation, known as "topping," should be carried out when the majority of the plants are in the right condition, and so avoid unnecessary traffic through the crop. At the

same time many growers "prime" the plants—that is, they remove three or four leaves from the base. These leaves are small, thin, soiled and broken, and generally useless. It is considered that by removing them the strength of the plant is concentrated in the more valuable leaves above. Another opinion is that these waste leaves are best left to protect the crop by keeping it up off the ground.

The check thus given to blossoming results, among other things, in a renewal of vegetative growth that takes the form of young shoots—usually called "suckers"—which develop in the axils of the main leaves. These must be removed before they attain a length of 3 in. Suckering is usually best done once a week, and may require to be repeated two or three times.

LAYING OUT HOME GARDENS AND GROUNDS.

The many new homes being erected in town and country demand consideration of the subject of the home garden. The present time is most suitable, as the autumn is the time above all others for carrying out this class of work, and as its success depends more than anything on careful study and consideration of the undertaking the scheme is best drawn up now. It is best to actually plan the proposals first on paper, as ideas, however good, may not harmonize, but when sketched out their association with each other can be studied.

The first idea to get hold of is that the purpose of a garden is not merely a sentimental regard for beauty. Although the removal of the feeling of newness and bareness about a new home is important it is comparatively incidental, and is best realized by attention to the practical amenities. For instance, as it is inconvenient and unsightly for pools of storm-water to lie for any time about the house, it is necessary to grade and drain the land, especially footpaths and approaches, and to metal them and provide sumps and culverts to carry away storm-water.

Shelter from prevailing winds and screens for unsightly views demand suitable blocks of trees and shrubs to be planted. For shade in summer and a certain amount of privacy further planting will be required, although distant and attractive views must not be obscured. In selecting these plants one's own preference should not be considered so much as the suitability of the shrubs and trees for the locality. Our primeval forests have taught us that each locality has its own natural plant associations, and best results are obtained by following nature in this respect. Not that it is necessary to confine oneself to planting only native trees, for exotics have the same preference for special localities, and these should be studied. A common mistake is to plant too many kinds of trees and shrubs, when variety could be better obtained by planting more varieties of the few special subjects that are suitable. If the locality is suitable for, say, lilacs and hydrangeas an uncommon and effective method would be to plant a number of the many distinct and attractive varieties of these plants that may now be obtained. In many localities where the soil is considered poor heaths and rhododendrons do well, and by planting well-arranged distinct varieties of those shrubs a small garden can be furnished well without planting much else.

Another lesson nature teaches that might well be considered here is the fact that instead of these trees and shrubs growing as isolated specimens they are usually closely associated in the wild state. The shrubs grow among the trees, and especially about the margin of plantations. The improved results from such close association are often very remarkable. Ferns and even many herbaceous plants prefer this partial shade, which is their natural environment. The contrast with the open grassed lawns is convenient and effective.

For the purpose of tennis and other games it is necessary to go to the labour of forming level greens, and on town sections these are appropriate. But in larger gardens and in the country the result will be equally good and frequently better if the grass surface is merely smooth and sown with dwarf permanent grasses found growing naturally in the locality. —*W. C. Hyde, Horticulturist.*

FARM ECONOMICS WORK OF AGRICULTURE DEPARTMENT.

At the last meeting of the Board of Agriculture, held at Wellington, the Director-General, Agriculture Department, communicated to the Board an outline of the progress which is being made by the Farm Economics Branch of the Fields Division in its investigations.

At the present time the work in hand embraces—(1) A survey of mixed farming in Canterbury; (2) an investigation into the cost of producing wool and meat, and their relationship to each other; (3) an investigation into the cost of producing butterfat.

In every case an endeavour is being made to study the whole farm as a unit, rather than follow a detailed system of cost accounting. From such a study it is considered that it will be possible to ascertain the per-acre production of a farm, and that by careful study the cost may be broken up fairly accurately into its respective branches.

Good progress is being made in Canterbury; offers of assistance are being received from sheep-farmers in the North Island; the dairy position is being investigated in the Manawatu, Wairarapa, and Waikato districts.

The Board was advised that some farmers are rather diffident about disclosing their financial position. It therefore considers it wise to point out that the identity of the individual furnishing information is lost in the Department, inasmuch as each form is numbered and the name of the person supplying the information does not appear on the form at all. In any case all information is treated as strictly confidential, and the Board therefore trusts that all those approached will assist the departmental officers to the best of their ability, as it is highly desirable, in the interests of producers as a whole, that accurate information concerning the cost of production should be secured and published.

Poultry-keeping as a Side-line.—"While there is ample room for the extension of large commercial plants," remarks the Chief Poultry Instructor in his annual report for 1925–26, "the industry holds out the greatest promise to the side-line poultry-keeper, especially to the small settler on the land. At the present time there are few farms in the Dominion where poultry are not kept on a moderate scale, but, unfortunately, in the majority of cases improvement is required both in regard to the quality of the stock and their management. It is a matter for regret that more farmers do not avail themselves of the free practical advice and assistance which is available to them per medium of the Poultry Instructors, and printed matter issued by the Department at a minimum of cost."

WEATHER RECORDS: NOVEMBER, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

NOVEMBER is regarded as the last month of spring, and as such the month under record may be characterized as more than usually wet, windy, and cold. The outstanding feature of the month were the great floods in the Buller, Waimakariri, and Wairau Rivers in the first week of the month. The heavy rains at the end of the preceding month had soaked the land and swollen the streams, as well as leaving snow on the uplands, and when on 3rd November an extensive westerly low-pressure, laden with vapour, made its appearance many things combined to account for record floods. It rained every day from 27th October to 6th November in many places on the South Island west coast, and the falls were extremely heavy in the high country. Following are some of the daily falls recorded in the region mentioned :—

	3rd Nov. Inches.	4th Nov. Inches.	5th Nov. Inches.
Arthur's Pass	4·94	12·70	0·80
Greymouth	1·34	2·26	0·49
Reefton	1·96	2·28	0·50
Westport	1·40	1·91	0·31

Rainfall was in excess in all parts of the country, except in Hawke's Bay and some districts in Otago.

Thunderstorms, with hail, were reported in many places, and one in Hawke's Bay, on the 12th, did much damage to orchards.

Several light frosts occurred, particularly in the South Island, and the cold southerly wind which brought snow on the uplands on the 27th and 28th caused loss in newly-shorn sheep. Shearing and haymaking were greatly retarded, and growth in vegetation was backward for the time of year in many parts of the Dominion.

RAINFALL FOR NOVEMBER, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
		North Island.		
	Inches.		Inches.	Inches.
Kaitaia	5·36	17	1·50	3·27
Russell	4·32	15	1·90	1·61
Whangarei	4·03	15	1·77	3·41
Auckland	7·54	24	2·06	3·26
Hamilton	6·22	25	1·04	4·04
Kawhia	6·58	25	0·96	4·49
New Plymouth	6·89	21	0·88	4·61
Riversdale, Inglewood	11·20	23	1·48	8·95
Whangamomona	7·60	16	1·48	7·40
Tairua	5·10	20	1·62	3·55
Tauranga	5·73	20	1·58	3·29
Maraehako Station, Opotiki ..	5·10	18	1·24	2·78
Gisborne	3·56	9	1·29	3·02
Taupo	3·92	14	0·61	3·41
Napier	1·37	13	0·30	2·51
Maraekakaho Station, Hastings ..	1·62	14	0·44	2·03
Taihape	5·84	20	1·34	3·69
Masterton	3·19	13	1·23	2·73
Patea	8·38	20	1·91	3·72
Wanganui	4·24	12	1·32	3·31
Foxton	3·08	12	1·00	3·24
Wellington	4·83	20	1·49	3·42

RAINFALL FOR NOVEMBER, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
South Island.				
	Inches.		Inches.	Inches.
Westport	7·89	24	1·91	7·08
Greymouth	9·50	19	2·26	9·46
Hokitika	13·00	19	3·37	10·73
Ross	13·76	15	2·18	13·94
Arthur's Pass	33·11	21	12·70	15·00
Okuru, Westland	12·60	16	2·12	12·96
Collingwood	7·30	17	1·30	7·68
Nelson	3·74	17	0·89	2·93
Spring Creek, Blenheim	4·25	16	1·20	2·41
Tophouse	10·01	20	1·65	7·07
Hanmer Springs	6·55	15	2·36	2·74
Highfield, Waiau	4·00	10	1·12	2·52
Gore Bay	3·18	13	0·81	1·98
Christchurch	3·98	15	0·87	1·87
Timaru	2·46	13	0·90	1·96
Lambrook Station, Fairlie	2·40	12	0·48	2·00
Benmore Station, Clearburn	2·61	14	0·56	2·05
Oamaru	2·64	10	0·78	1·93
Queenstown	3·09	12	0·78	2·77
Clyde	1·13	10	0·28	1·36
Dunedin	4·04	19	1·01	3·27
Wendon	3·70	16	0·67	2·54
Gore	3·18	17	0·53	3·31
Invercargill	3·82	23	0·48	4·40
Puysegur Point	10·18	23	1·14	8·36

—*D. C. Bates, Director.*

BOOKS RECEIVED.

NEW ZEALAND FLOCK BOOK (SOUTH ISLAND): Volume xxii, 1926. Published by the Council of the New Zealand Sheep Breeders' Association (South Island), Christchurch.

RESEARCH AND THE LAND: An Account of Recent Progress in Agricultural and Horticultural Science in the United Kingdom. By V. E. Wilkins, Assistant Principal, Ministry of Agriculture. H.M. Stationery Office, London, 1926 (New Zealand Agents: Government Printer and Gordon and Gotch). Paper cover, 2s. 6d.; cloth, 3s. 6d.

ECONOMICS OF PRODUCTION OF GRADE A (TUBERCULIN-TESTED) MILK. By V. Liversage, Agricultural Economics Research Institute, University of Oxford. Clarendon Press, Oxford, 1926. 2s.

PRELIMINARY REPORT OF AN INVESTIGATION INTO THE ARTIFICIAL DRYING OF CROPS IN THE STACK. Institute of Agricultural Engineering, University of Oxford. Clarendon Press, Oxford, 1926. 2s. 6d.

INTERNATIONAL YEARBOOK OF AGRICULTURAL LEGISLATION, 1926 (covering year 1925). Published by the International Institute of Agriculture, Rome. 12s. 6d.

INTERNATIONAL YEARBOOK OF AGRICULTURAL STATISTICS FOR 1925–26. Published by the International Institute of Agriculture, Rome. 100 lire, or English money equivalent at current rate of exchange.

CHEMISTRY FOR AGRICULTURAL STUDENTS. By R. H. Adie, Lecturer in Physics and Chemistry, School of Agriculture, Cambridge. University Tutorial Press (Limited), London. 5s. 6d.

THE DAIRY INDUSTRY AMENDMENT ACT, 1926.

1. This Act may be cited as the Dairy Industry Amendment Act, 1926, and shall be read together with and deemed part of the Dairy Industry Act, 1908 (hereinafter referred to as the principal Act).

Remedying Defects.

2. Section six of the principal Act is hereby amended by adding the following paragraph: "(*aa.*) That any dairy-produce produced in or stored on any dairy is likely to be contaminated by reason of any structure or other thing situated in the neighbourhood of the dairy, or of any operations carried on or of any conditions obtaining in the neighbourhood thereof."

Apportionment of certain Expenditure between Landlord and Tenant.

3. (1.) In the case of a farm where the relationship of landlord and tenant exists between the owner and the actual occupier thereof the following provisions as to the apportionment of the expenditure shall, in the absence of an express agreement to the contrary, apply where expenditure on buildings or other permanent improvements of the farm is rendered necessary by reason of an order of an Inspector made pursuant to sections six and seven of the principal Act: (*a*) If the interest of the tenant at the time the expenditure is incurred is for a term of not more than two years and six months the whole of the expenditure shall be borne by the landlord; (*b*) if the interest of the tenant at the time the expenditure is incurred is for a term exceeding two years and six months the tenant shall pay a sum equal to five per centum of the total expenditure for each year of the unexpired term of his interest, and the landlord shall pay the balance, if any. If the term includes a broken period, and such period exceeds six months, it shall count in the computation as one year, but otherwise shall not be counted: Provided that, in either of the cases aforesaid, if the business of dairying has not previously been carried on on the farm and the tenant commences such business without the consent in writing of his landlord the tenant shall bear the whole of the expenditure.

(2.) If any landlord or tenant pays more than his proper proportion hereunder of such expenditure he may recover the excess from his tenant or landlord (as the case may be) as a debt due to him, and any tenant may set off any sum recoverable by him under this subsection against any rent payable to his landlord.

(3.) Where an order involving expenditure to which the provisions of this section will apply is served on a tenant, he shall forthwith forward a copy thereof to the landlord; and if the tenant incurs any expenditure without taking such action as aforesaid the landlord shall not be liable to make any contribution towards the expenditure in terms of this section.

(4.) A copy of this section shall be printed on every such order as aforesaid.

Certain Nuisances not allowed near Dairy.

4. Section twelve of the principal Act is hereby amended by omitting from subsection one the words "A person shall not keep pigs or permit them to be kept," and substituting the words "A person shall not keep, house, or pen pigs, or permit them to be kept, housed, or penned, or to wander or be brought."

Cooling of Milk or Cream.

5. Section sixteen of the principal Act is hereby amended as follows: (*a*) By omitting the words "by being passed over a cooler or aerator," and substituting the words "in manner prescribed"; and (*b*) by adding the words "and a person shall not supply or sell to any dairy any cream unless such cream has been properly cooled, in manner prescribed, immediately after being separated."

Butter containing less than 80 per Centum of Butterfat not to be exported.

6. (1.) Paragraph (*d*) of subsection one of section twenty-two of the principal Act (as set out in subsection one of section two of the Dairy Industry Amendment Act, 1915) is hereby amended by inserting, after the words "more than sixteen per centum of water," the words "or less than eighty per centum of butterfat."

(2.) Subsection two of section two of the Dairy Industry Amendment Act, 1915, is hereby consequentially amended by inserting, after the words "more than sixteen per centum of water," the words "or less than eighty per centum of butterfat."

Differential Prices for Different Grades of Milk and Cream.

7. The power conferred by the principal Act to make regulations is hereby extended to include power to make regulations requiring owners of dairy factories to pay different prices for different grades of milk or cream supplied to such factories for manufacture, and fixing the minimum amounts by which the prices shall vary for the different grades. Regulations in regard to the grading of cream may provide for a classification of cream according to the percentage of butterfat therein, and the power herein contained to require the payment of different prices according to grade and to fix the minimum variation in the prices shall extend to include a power to require the payment of different prices according to the classification of the cream, and to fix the minimum variation in such prices.

Dairy Companies not to describe themselves as Co-operative unless actually so.

8. (1.) No company which has for its object or one of its objects the manufacture of butter, cheese, dried milk, casein, or other article from milk or cream, or the collection, treatment, and distribution for human consumption of milk or cream, shall be registered under the Companies Act, 1908, under any name which includes the word "co-operative" or any word of like significance unless it is entitled to be registered as a co-operative dairy company under Part III of the principal Act.

(2.) At any time after the first day of April, nineteen hundred and twenty-seven, the Registrar of Companies may by notice call upon any such company as aforesaid heretofore registered under the Companies Act, 1908, under a name signifying that it is co-operative in character but which is not entitled to be registered under Part III of the principal Act, or upon any company so named the registration of which under the said Part III has at any time been cancelled, to take steps to change its name so as to remove therefrom the signification that it is a co-operative dairy company, and the company shall not later than one month from the date of the notice from the Registrar take the appropriate steps under the Companies Act, 1908, to effect the change of its name.

(3.) After the first day of April, nineteen hundred and twenty-seven, it shall be the duty of every company which is registered under Part III of the principal Act, or which is entitled to be so registered, and of every company to which the last preceding subsection applies, at all times until it has changed its name as required by that subsection, to furnish to every person (not being a shareholder of the company) engaged in supplying milk or cream to the company a copy of every account, report, or balance-sheet which by virtue of its articles or otherwise it is required to furnish to its shareholders, in the manner and within the times prescribed in respect of shareholders.

(4.) If any company fails for thirty days to comply with the provisions of the last preceding subsection the chairman and every director thereof shall be severally liable to a fine of ten pounds.

KILLINGS AT MEAT-WORKS, SEASON 1925-26.

STATISTICS issued by the Meat Producers Board show the total killings at meat-works in New Zealand for the frozen-meat industry year, 1st November, 1925, to 31st October, 1926, as follows:—

Class.	North Island.	South Island.	Dominion.	Dominion, Season 1924-25.
Lamb (carcases)	2,375,318	2,625,272	5,000,590	4,750,164
Wether mutton (carcases) ..	1,071,592	152,162	1,223,754	1,271,221
Ewe mutton (carcases) ..	514,631	262,955	777,586	953,042
Beef (quarters)	211,619	3,975	215,594	458,549
Pork (carcases)	60,613	144	60,757	35,753
Boneless beef (freight carcases)	189,663	33,752	223,415	263,738
Sundries (freight carcases) ..	97,571	13,658	111,229	54,961

LIVE-STOCK IN NEW ZEALAND, 1926.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1925–26.	Number of Lambs tailed, 1925–26.	Sheep (including Lambs) as at 30th April, 1926.	Pigs.	Goats.	
				In Milk.	Dry.					Angora.	Other.
North Auckland ..	35,685	50	477,098	179,768	21,393	767,010	332,113	818,202	72,302	631	1,871
Auckland	45,960	2	705,656	308,992	22,511	980,596	494,173	1,010,809	132,320	821	2,451
Gisborne	19,273	51	339,447	26,889	5,258	2,838,744	1,251,762	2,976,255	13,641	315	1,657
Hawke's Bay ..	16,487	4	246,427	46,446	8,311	2,739,414	1,366,978	2,916,689	16,849	1,043	1,776
Taranaki	20,873	1	374,184	193,929	11,155	813,093	367,734	787,077	57,828	284	4,076
Wellington	41,942	22	681,392	180,957	20,780	5,113,742	2,532,458	5,408,119	72,716	621	703
Nelson	7,386	3	65,692	25,847	3,777	365,691	134,274	422,459	14,658	696	1,067
Marlborough	7,161	..	45,681	15,553	1,994	961,388	406,876	1,040,063	7,179	314	3,057
Westland	2,422	1	42,207	10,997	2,253	57,836	38,500	63,137	5,865	27	48
Canterbury	58,790	10	187,054	76,060	9,647	4,019,996	2,390,863	4,711,837	48,370	182	96
Otago	33,330	13	128,773	50,243	7,968	2,629,328	1,298,478	3,121,881	19,615	11	9
Southland	25,558	4	158,875	65,760	7,368	1,398,862	821,571	1,628,465	11,191	..	5
Dominion totals ..	314,867	161	3,452,486	1,181,441	122,415	22,686,200	11,435,780	24,904,993	472,534	4,945	16,816
Totals 1925 (or 1924–25)	326,830	190	3,503,744	1,195,567	127,865	22,335,528	11,467,147	24,547,955	440,115	5,696	13,279

CROP AREAS AND YIELDS: SEASONS 1924-25 AND 1925-26.

Crop.	1924-25.		1925-26.	
	Area.	Yield per Acre.	Area.	Yield per Acre.
	Acres.		Acres.	
Wheat—				
Grain	166,964	32·62 bushels	151,673	30·44 bushels.
Chaff, &c... ..	1,105	1·59 tons	857	1·35 tons.
Oats—				
Grain	147,387	38·72 bushels	102,485	40·14 bushels.
Chaff, &c... ..	308,527	1·64 tons ..	245,026	1·45 tons.
Barley—				
Grain	25,138	31·75 bushels	25,969	36·47 bushels.
Chaff, &c... ..	242	1·64 tons ..	370	2·14 tons.
Maize—				
Grain	8,621	49·47 bushels	8,508	49·75 bushels.
Ensilage	600	4·02 tons ..	557	3·01 tons.
Peas and beans ..	14,027	29·27 bushels	11,749	24·48 bushels.
Linseed—Seed ..	6,679	0·32 tons..	8,143	0·29 tons.
Rye-grass—Seed ..	66,764	452·34 lb. ..	45,154	456·77 lb.
Cocksfoot—Seed ..	12,254	150·39 lb. ..	9,745	173·90 lb.
Chewings fescue—Seed	4,459	268·69 lb. ..	6,902	228·12 lb.
Crested dogstail—Seed	1,969	198·42 lb. ..	2,679	174·96 lb.
Red clover and cow-grass—Seed	10,400	159·92 lb. ..	6,579	185·16 lb.
White clover—Seed ..	3,196	151·73 lb. ..	5,358	176·13 lb.
Other grasses and clovers —Seed	4,113	272·12 lb. ..	3,132	153·55 lb.
Grasses and clovers cut for hay	229,644	1·83 tons..	224,777	1·76 tons.
Potatoes	23,092	5·27 tons..	23,484	6·09 tons.
Green fodder crops ..	240,061	..	255,429	..
Turnips	452,894	..	468,475	..
Mangolds	15,111	..	13,296	..
Onions	548	9·90 tons..	514	8·73 tons.
Hops	744	1,542·57 lb. ..	648	1,159·59 lb.

IMPORTATION OF SEEDS FROM THE UNITED STATES.

EARLY in 1924 outbreaks of foot-and-mouth disease in the United States of America made it necessary that precautions should be taken against the introduction of the disease into New Zealand. To this end regulations were made prohibiting the importation of products of the soil from the States of California, Washington, Oregon, and Texas. The disease having since been stamped out in the affected regions it was considered safe to modify the regulations. The prohibition has therefore been revoked in so far as it relates to products other than seeds. It has been deemed necessary to continue the prohibition of the importation of flower, vegetable, grass, clover, and tree seeds (but not grain) which, being the produce of California or Texas, were harvested prior to 1st April, 1926. Further, to ensure that such seeds are not imported, consignors' certificates of origin are required to accompany each consignment of seeds from the United States. In the case of seeds grown in States other than California or Texas it is sufficient that certificates should show the State in which the seeds were grown, but for seeds from these two States this certificate must be supplemented by a statement that they were not harvested prior to 1st April, 1926.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT OF HORSES FOR WORMS.

E. J. PERRY, Waihao Downs :—

I should be glad if you would give information as to best treatment for a horse that has red worms.

The Live-stock Division :—

There are several species of parasites affecting horses, but no doubt the ones to which you refer belong to the *Sclerostomum* family. These in the adult stage infest the cæcum and colon, but during their life-history undergo several changes. One species passes its larval stage in the walls of the intestines, and another in the walls of blood-vessels. Any treatment, therefore, to be successful needs repetition at intervals, in order to reach these larvæ when they mature. The following treatment has been found very effective: Remove the horses from damp and infected pastures, and feed on nutritious dry feed; then give two or three bran mashes, following which the animals should be allowed to fast for twenty-four hours. After this the following mixture is given: Oil of chenopodium, 4 drams; linseed-oil, 1 quart. This is the dose for a full-sized aged draught horse. Smaller doses of chenopodium would be necessary for younger and smaller horses. Of course, prevention is preferable to treatment. The ova or eggs of these parasites are voided in the fæces and are hatched out on the ground, where the larvæ can remain for long periods—especially in damp places. They can enter their host along with the feed, which thus becomes contaminated. Where trouble of this nature has occurred and the ground is possibly infested, it is advisable (1) to remove the horses (especially young ones) on to dry pastures; (2) to feed them on nutritious fodder obtained from dry pastures; (3) to allow the animals to fast for from twelve to twenty-four hours and then give the following: Hydrarg. subchlor., 1 dram; antim. potass. tartrate, 1 dram; ferri sulph., 2 drams; pulv. aloes, 2 drams; Saponis mollis, sufficient to make a ball: one to be given to each horse every two months. It would be necessary for a chemist to mix this up for you. Young and small horses would require smaller doses. Another form of red worm is found in the rectum, and an injection of vinegar and soapy water followed by a drench of turpentine, 1 oz., and linseed-oil, 1½ pints, has been successful.

CLEARING AND GRASSING MANUKA AND GORSE AREA.

J. B. RAMWELL, Okoia :—

I have a steep hillside carrying manuka and patches of gorse, and am having the gorse grubbed now. Would it be better to cut the manuka this summer and burn in the autumn, or to cut the manuka in twelve months' time and give the gorse-seed time to germinate before burning? The face is heavy clay with very little depth of earth, and is inclined to be shady. The total area is about 60 acres. What would be a good grass mixture to sow after the burn? Would paspalum be suitable?

The Fields Division :—

If there is much gorse it would be advisable to let it lie over the season, then cut the manuka next summer, and burn the whole the following March, taking care that the land is thoroughly dry, so as to ensure a good fire to destroy the manuka-seed. This will give the gorse a good check. If there are only small patches of gorse the manuka may be cut this season and the whole burnt in March, as suggested above. Sowing should take place immediately after the burn, and, if possible, before the ashes have been wetted by rain. Paspalum does not thrive very well on the dark faces in your district, but is useful on the more open warm faces. The following

mixture per acre is recommended: Italian rye-grass, 3 lb.; perennial rye-grass, 8 lb.; crested dogstail, 4 lb.; brown-top, 1 lb.; Danthonia pilosa, 2 lb; paspalum, 1 lb.; white clover, 1 lb.; Lotus major, ½ lb: total, 20½ lb. If your land is already carrying a fair amount of danthonia this may be omitted from the mixture.

DESTROYING HEMLOCK.

"ORCHARDIST," Ettrick :—

What is the best method of killing hemlock, or carrot-fern? Can it be killed by spraying with bluestone, and, if so, what strength should be used? Is there any other cheap weed-killer that can be used in the orchard-sprayer capable of killing hemlock?

The Horticulture Division :—

The best way to destroy hemlock-plants is to cut them off with a sharp implement of any kind well below the surface of the ground—early in the New Year for preference. Like the carrot and parsnip, hemlock is a biennial plant which, after growing for two seasons, produces a crop of seed and dies. Owing to its poisonous nature the cut plants when wilted should be gathered and placed out of reach of stock. To use a weed-killer in the orchard spray-pump, as you suggest, is undesirable, owing to the possibility of burning the fruit-trees afterwards.

SOW FAILING TO BREED.

C. E. NICHOLSON, Motueka :—

I have a young purebred Berkshire sow that has repeatedly returned to the boar. Although she had one litter of pigs about two years ago she has failed to breed since. Would you please advise me what to do?

The Live-stock Division :—

In this instance it is difficult to state what the actual cause of sterility might be. Very frequently sterility in sows is brought about by a too fat condition of the animal, and it is always worth while to try the effect of a diet leading to considerable reduction in condition. You do not mention if the sow shows any signs of discharge. Inflammation of the womb is occasionally a cause of sows not breeding. Treatment is difficult, but irrigation of the womb with a very weak solution of Condy's crystals in water might be tried. It is also advisable in these cases to change the boar.

FEEDING MAIZE TO PIGS.

E. ATKINSON, Te Puke :—

I fed whole maize-corn to my pigs, and noticed it went through them whole. I then gave it crushed, but it passed through them the same size as when fed. Kindly tell me the most profitable way to feed maize.

The Live-stock Division :—

Maize is an excellent food for pigs when given in conjunction with skim-milk, but, owing to the fact that it is deficient in mineral matter and less so in protein, it is not a suitable grain to be fed alone. The best way to feed maize to growing pigs is to throw the cobs to the pigs and let them pick off the grain, or to scatter the grain on to a clean concrete floor or dry yard and allow the pigs to pick up each grain separately. In either of these ways the pig will masticate the grain and be able to digest and assimilate the food. If neither of these methods can be carried out satisfactorily the next best way is to feed the maize as meal in the dry state by means of a self-feeder, or by giving the meal twice daily in the trough after the milk. Maize-meal should not be fed in the usual swill, but, if desired to soften it, it may be soaked for a few hours and given in a little liquid so that the mixture has a consistency like that of soft porridge. Similarly, the grain may be soaked for twelve hours and then fed by itself. The daily ration of maize for pigs varies from 1 lb. to 3 lb. for every 100 lb. weight of pig, and according to the age of the animal.

ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are complete estimates of the current season's lambing, computed from estimated average percentages furnished by Inspectors of Stock in the various districts. Corresponding figures for the five previous years, together with the actual numbers of lambs tailed, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
		NORTH ISLAND.		
1926 ..	7,503,200	84·35	6,329,338	..
1925 ..	7,463,735	85·64	6,391,812	6,345,218
1924 ..	7,148,949	85·00	6,049,654	6,199,881
1923 ..	7,170,154	91·34	6,549,143	6,170,673
1922 ..	6,771,482	90·36	6,118,530	5,955,081
1921 ..	6,312,456	89·65	5,659,355	5,457,643
		SOUTH ISLAND.		
1926 ..	6,445,052	84·79	5,465,361	..
1925 ..	6,251,488	78·61	4,914,046	5,090,562
1924 ..	5,927,145	87·87	5,208,378	5,267,266
1923 ..	5,892,849	83·99	4,949,313	4,962,663
1922 ..	5,724,572	82·53	4,724,475	4,949,440
1921 ..	5,835,332	83·28	4,895,425	4,810,258
		DOMINION.		
1926 ..	13,948,252	84·57	11,794,699	..
1925 ..	13,715,223	82·43	11,305,858	11,435,780
1924 ..	13,076,094	86·14	11,258,032	11,467,147
1923 ..	13,063,003	88·02	11,498,456	11,133,336
1922 ..	12,496,054	86·77	10,843,005	10,904,521
1921 ..	12,147,788	86·59	10,518,780	10,267,901

—*Live-stock Division.*

FIREBLIGHT ACT REGULATIONS.

REGULATIONS under the Fireblight Act, 1922, gazetted on 25th November, create two new commercial fruitgrowing districts—namely, Whangarei and Gisborne. Such districts are subject to measures that may be prescribed for dealing with hawthorn in the respective areas. Details of the boundaries of the new districts are given in the *Gazette*.

ARGENTINE EMBARGO ON NEW ZEALAND FRUIT.

IN December, 1925, owing to the alleged presence of Mediterranean fruit-fly in the Dominion, the Argentine Government prohibited the importation of New Zealand fresh fruit and vegetables into Argentina, this principally affecting the trade in apples. Owing to representations made the embargo was provisionally lifted last January, and it has now been definitely removed. This decision is taken to be the result of the favourable report given by Messrs. Trelles and Blanchard, the Argentine officials who visited New Zealand last summer.

Eggs and Egg-pulp in Cold Storage.—The quantities returned as at 31st October, 1926, are as follows: Eggs in shell—North Island, 9,435 doz.; South Island, 14,510 doz.; Dominion, 23,945 doz. Egg-pulp—North Island, 331,083 lb.; South Island, 120,662 lb.; Dominion, 451,745 lb.